Chemical Gardens

CHEMISTRY

CLASS
LIBRARY

AUGUST
1945

Growing Chemical Crops 1
Hydroponics in Your Home 9
Artificial Oceans for Raising Fish 11
Carboloy Core Pierces Armor 13
Anti-Fatigue Chemical Studied 15
Rubberized Cloth Used Early 17
X-rays Alter Properties of Crystals 18
Chem Quiz: Who, When and Where? 19
Cool Metallic Clouds in Variable Star 20
Growths of Evil 21
Chemical Things To Do:
Juices Detect Acids or Alkalis 23
Low-Grade Ore Yields Nickel 25
Available Patents Listed 27
Sulfur in the Metabolism of Industry 33
And Now—Oral Penicillin! 36
Gadgets Chemists Can Use 38
Rare Alcohols from Improved Cattle Diets 39
Twenty Years Ago This August 43
Give Peaceful Nations Minerals 44
Editorial:
Atomic Power .....Inside Front Cover

25¢

★ A SCIENCE SERVICE PUBLICATION ★

Atomic Power

➤ THE SECRET of the atom is out at last! The atomic bomb is a reality. The shades of the ancient alchemists can at least claim that the time they spent over their alembics was not wasted. The writers of scientific romances can now wait breathlessly to see when the doom of the world, that they have long predicted, will start. The industrialist can begin to plan what miracles he can perform with a pint-size power plant. The man-in-the-street can wonder what new calamities will befall him as the result of this new weapon of destruction.

When the curtain of secrecy for security fell, the world at large knew about the spontaneous radioactivity of the heaviest elements, and that a small amount of "atom smashing" on a hit-or-miss basis had been achieved on a small scale. Apparatus for larger scale experiment was building. Relatively little was known of the effects on the human body of the rays the disintegrating atoms would give off in such concentration. Experimenters were not too anxious to find out. Thick lead screens were built for protection, and control rooms were placed at safe distances from disintegration chambers.

When war broke out, American scientists knew that their opponents in German laboratories were using the world's stock of information on sources of atomic power. The race for mastery of its application was on.

The statement of the Secretary of War points up the difference between the Germans' self-sufficient attitude and the co-operation which pooled the scientific resources of the Allied nations. While suspicion and hate were weakening German science, the United States, the United Kingdom and Canada were working out the methods by which interchange of information and combination of effort can be used for the common good. The greatest research project ever undertaken has reached its first goal. The problems it has solved will go far toward settling many of the problems of peace.

CHEMISTRY

Vol. 18, No. 12 — Formerly The Chemistry Leaflet, Including The Science Leaflet — August 1945

Published monthly by Science Service, Inc., the institution for the popularization of science. Publication Office: 119 South Frazier St., State College, Pa. Editorial and Subscription Office: 1719 N St., N.W., Washington 6, D. C. Entered as second-class matter at the Post Office, State College, Pa., under Act of Congress of March 3, 1879.

25c a Copy; $2.50 a Year. Two-Year Subscription $4; Your Own and a Gift Subscription $4. Quantity Subscriptions, 10 or more copies to same address: $1.70 a Year, $1 for any seven months, 15c each Copy each Month. No charge for Foreign or Canadian Postage.

Editors: WATSON DAVIS and HELEN MILES DAVIS
Consulting Editor: PAULINE BEERY MACK (Editor 1927-1944.)
Board of Consulting Editors in process of formation.

Copyright 1945 by Science Service, Inc. All rights reserved. Science Service issues press service for newspapers and magazines, publishes Science News Letter (weekly) and Overseas Science News Letter (monthly), issues THINGS of Science (monthly) and administers Science Clubs of America.

Science Service is the educational and scientific institution organized in 1921 as a non-profit corporation with trustees nominated by the National Academy of Sciences, the National Research Council, the American Association for the Advancement of Science, the E. W. Scripps Estate and the Journalistic Profession.

▶ TANKS *of chemical solution, under the white strips of cloth in the foreground, grow vegetables on soilless Ascension island.*

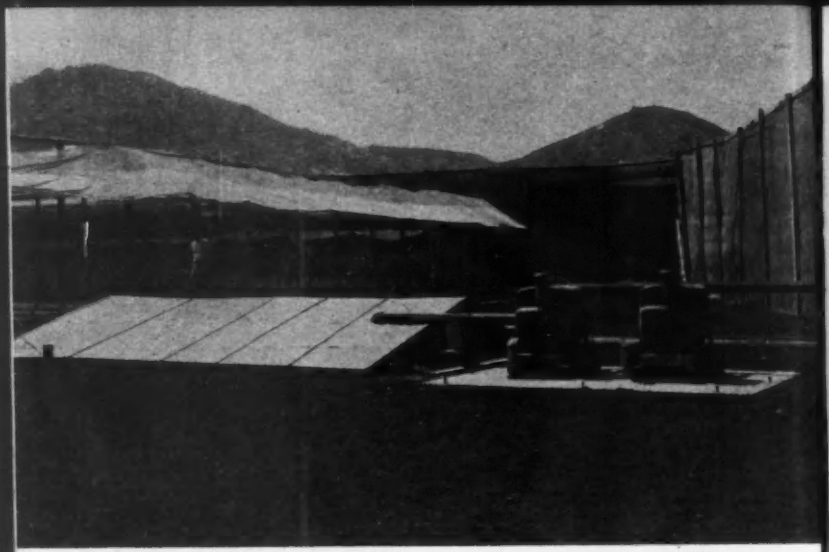
Growing Chemical Crops

by DR. FRANK THONE

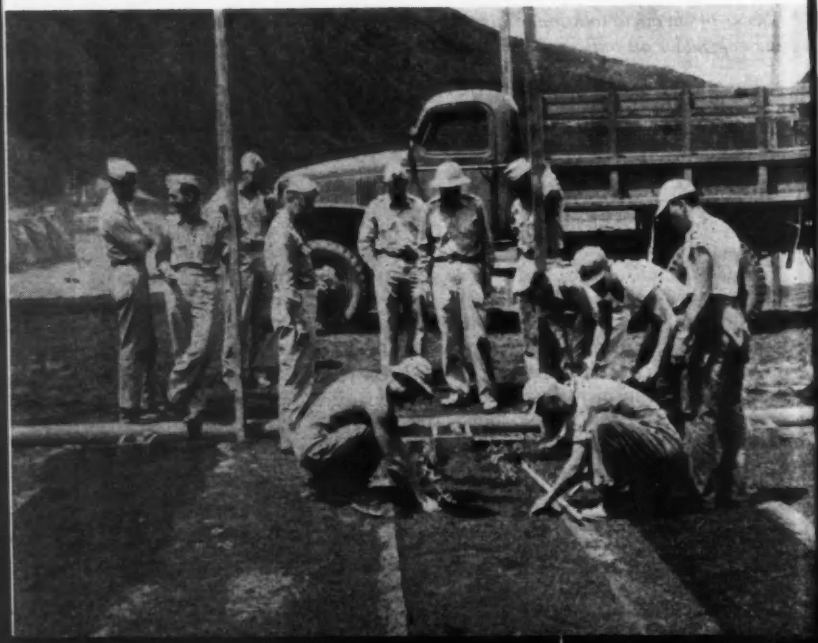
▶ RECIPE for GI contentment on a desert island:

To 7,000 gallons of distilled water add the following, in parts per million: nitrogen, 310; potassium, 390; phosphorus, 31; calcium, 160; magnesium, 24. Buffer with sulfuric acid —which will also incidentally add the necessary sulfur. Pour into a long, asphalt-lined trough filled with fine volcanic cinders; drain off surplus and save for re-use. Add seeds of tomatoes, lettuce, radishes, cucumbers and green peppers. Never mind about trace elements—iron, boron, copper and the rest—they'll be present either in the cinders or as impurities in your commercial-grade fertilizer salts.

Bake for five or six weeks under an equatorial sun, re-wetting cinders from time to time. Spray plants as they grow, to keep off insect pests. Gather in your results and serve t GI's who haven't seen a fresh tomato



▶ PUMPS *(above) circulate the life-giving solution through the system of cinder-filled troughs (below) where college-trained GI's are setting out seedlings.*



or a radish for a year or two. You'll learn from their reaction that when they call a good-looking girl a "tomato" the intention is strictly complimentary.

So important are tomatoes and other fresh vegetables considered, that the Air Quartermaster of the Army Air Forces has installed on Ascension island its first large-scale hydroponic or soilless garden. When the first harvestings were made, GI's lined up for chow with their mouths watering.

To appreciate how our men can work up so much emotion over just fresh vegetables, you really ought to see Ascension island. Despite its edifying name, the place looks literally like Hell. Or at any rate, like the pictures of that place in a popular edition of Dante's Inferno. It is a jumble of recently-erupted volcanic cinder cones, about 35 square miles in total area, lying a few degrees south of the equator. Except for one carefully tended green patch of trees and bushes on top of its highest peak, its surface is the bleakest desert in the world; scattered sparse grasses, bone-white crustose lichens over the rocks like carelessly sprayed paint, and occasional grotesque clumps of prickly-pear cactus comprise practically all of its natural vegetation.

Vital Airport

But this bleak bit of rock has tremendous importance because of its position, halfway between the "hump" of Brazil and the coast of Africa. It has long been a key British cable and radio station, and since the beginning of the war has become one of the most vital airports in the world. Through Ascension were routed the plane-loads of ammunition and supplies that helped keep Rommel out of Alexandria when things were tight in North Africa. Now that the war in Europe is over, it is still important as a refueling-point for fighter planes in transit for eventual action against the Japs in China. So a fairly large garrison comprising all arms, plus a smaller number of RAF men, has to be maintained there for the duration.

When the first crop was gathered permanent garrison and transient personnel together numbered about 2,000; the number of course is always fluctuating; there is also a small civilian population that takes care of the highly important cable station which the British have long maintained on Ascension.

Staple foods, that require cooking, can be brought in by ordinary shipping. But the fresh, green stuff that we all crave has to be raised on the spot, because it is impracticable to send it in either by refrigerator ship or cargo plane.

Attempting to grow green stuff on Ascension would seem at first glance to be almost as heroic an undertaking as gardening on the moon. Indeed, the island looks like a bit of the moon's surface, as depicted by astronomer-artists: its 35 square miles are simply a series of dead volcanic cones and narrow, cinder-choked valleys.

By all ordinary rules, it is impossible to raise fresh vegetables on this particular spot. Ascension island has no soil—nothing but volcanic ash and cinders. There is no water. It is almost

▶ GREENHOUSES *have cloth canopies that keep out the sun on this tropical island, and are built terrace-fashion to help collect the nutrient solution run-off for re-use.*

on the equator, with daily high temperatures, scorchingly bright sunlight, and the incessant southeast trade winds blowing.

"The impossible may take a little longer." A few months ago a civilian employe of the Army Air Forces, a salty Hoosier horticulturist named Kendrick Blodgett, tackled the job. He had already had considerable success in growing vegetables in the tropics; his last venture had been in Cuba.

Chemical Garden

Selecting one of the very few nearly-flat places on the island, Mr. Blodgett laid out the site for his garden. Army Engineers bulldozed the surface into four level terraces, step-fashion. Athwart the terraces they gouged out shallow, trough-like trenches, each eight inches deep and three feet wide, their four sections having a combined length of 400 feet. Sides and bottom were waterproofed with asphalt, coated with a non-toxic paint. All told, there are 25 sets of these long troughs, giving a total surface area of 30,000 square feet.

The Engineers filled the troughs with pebbly volcanic cinders, and constructed a system of pipes through which irrigation water could be admitted at the upper ends and drained off at the bottom. They set up poles and strung wires, so that cloth strips could be stretched overhead to give the plants partial shade from the too-intense equatorial noonday sun.

In the meantime, Mr. Blodgett recruited his corps of assistants. As his chief aid he has Lieut. John S. Fisher, who in civil life was an entomologist. He recruited a force of ten non-commissioned officers to help him, by having the entire Air Forces screened for young men who had attended agricultural colleges. These are the men who will aid him in carrying the soil-less gardening method to other islands. Seven more enlisted men, who had been farm boys before the war, were added to the working force out of ground personnel on the island itself.

One of Mr. Blodgett's eleven disciples had already had experience in hydroponic gardening; he raised flowers by that method in his own greenhouse in Philadelphia. Sgt. William Brientnall is a graduate of the Pennsylvania State College. He has been put in charge of the propagation house, where all plants except radishes are started; as his aide he has Sgt. William Buckley, a California Agricultural College graduate.

▶ RADISHES *form welcome bouquets which will appear once a week on mess-hall tables. The hotter they are, the better the GI's like them.*

A propagation "greenhouse" (with cloth instead of glass) was set up, and seedlings of all the crops except radishes were started in it. Radish seeds were sown directly in the gravel-filled trough. The seedling tomatoes and other plants were transferred when they reached proper size.

Water Scarce

Here as everywhere else, water is the key to life. Every drop of water that all the fighting forces here use for all purposes has to be distilled from the undrinkable brine of the ocean. Army Engineers have set up an oil-fueled distilling plant that is a marvel of efficiency under the circumstances; it produces about 30,000 gallons of good fresh water every 24 hours.

This distilled water is what has made it possible for the military Robinson Crusoes on this desert island to satisfy their natural craving for something green, to supplement what comes out of the shipped-in boxes and cans and bags.

Every other day the troughs are flooded with water in which the necessary mineral fertilizer salts have been dissolved. Then the excess liquid is drained into a sump at the lower end of the garden to be re-used in the next irrigation. Water economy is very important, since water used here, as well as for all other purposes in the garrison, has to be distilled out of brine pumped up from the sea. The 7,000 or 8,000 gallons consumed every week in the hydroponic garden is not the largest item in the island's over-all water use, but it is by no means negligible. The 70% of water recovered at the end of each irrigation is a most welcome saving.

Five Crops

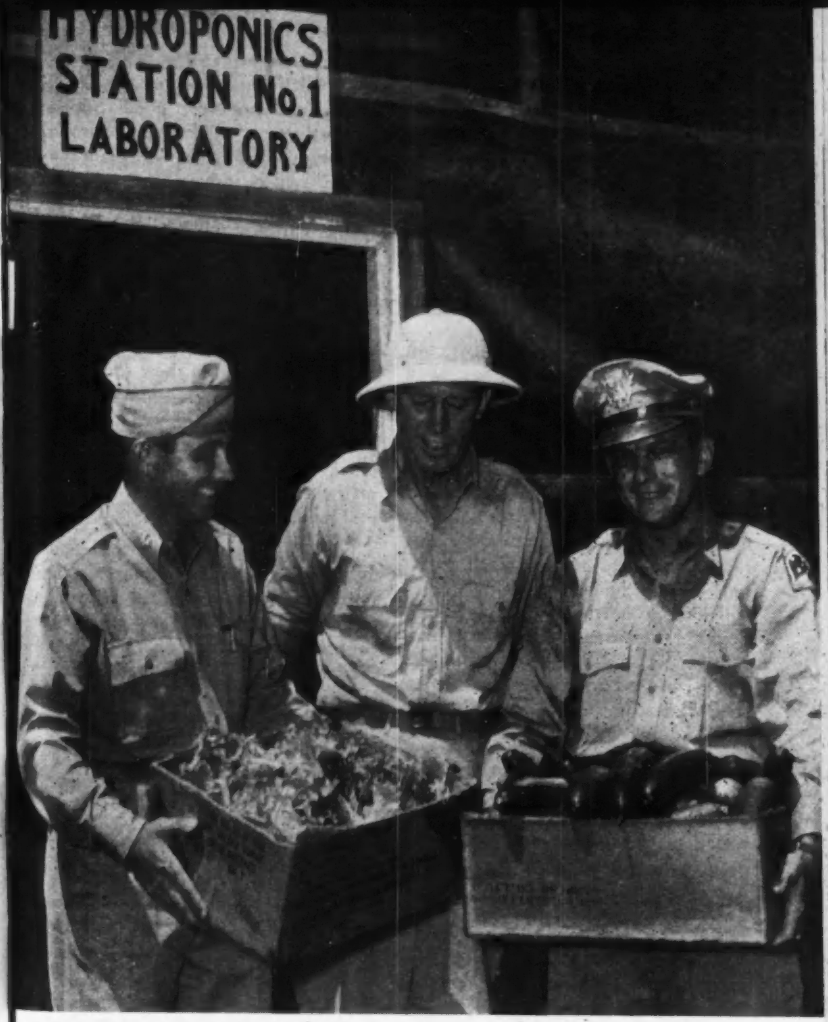
Now, at the beginning of what is expected to be a fairly continuous harvest (since there are no seasons on the equator) it is expected that there will be enough lettuce and cucumbers to serve all the men at least twice a week, radishes for one meal a week. Peppers will be a minor item, just enough to garnish the salads.

Mainstay will be tomatoes. Tomatoes for everybody twice a week at the outset is the promise, and eventually tomatoes every day if you want 'em. And you may be sure the GI's will!

These five vegetables will constitute the regular crops of the hydroponic garden. Under the limitations imposed by space and working force available, it is considered best not to attempt growing vegetables that require cooking.

The whole installation, covering a space as big as a large city square, is partially roofed with white cloth supported on wire, like a Connecticut tobacco field; the strips are arranged to give protection from the noon sun to part of the beds, but over some of them, especially the cucumbers, the covering is complete. There are also windbreak-fences around the sides, to check the drying sweep of the southeast trade winds that blow endlessly over the island.

Some interesting problems have been encountered in connection with



➤ DIRTLESS FARMERS *bring in the harvest. Kendrick Blodgett, center, who runs the hydroponic garden, looks over the first crop. Lt. Col. John D. Torrey, commanding officer of the forces on Ascension island, left, displays the lettuce, which is cut leaf by leaf, to keep the plant producing as long as possible. Capt. Floyd C. Chitty, Engineer, right, holds a box of cucumbers for the garden salad.*

this soilless garden on a desert island. Cucumbers and green peppers need bees for pollination, and there were no bees on Ascension. So a hive of them was brought, by plane, from Brazil, 1400-odd miles away.

Tomatoes are normally able to pollinate themselves, but for some reason the pollen they produced here was scanty and not very good. So each flower gets a squirt of a growth-promoting substance, or plant hormone, which induces the formation of seedless fruit. Ascension tomatoes, being partially pollinated, do have seeds, but very few of them.

New Installations in Demand

After the war, Uncle Sam is going to find himself in possession of a whole flock of desert islands. He doesn't especially want them, but after dispossessing the Japs at high cost in American boys' lives he won't feel like throwing them away again.

Some of them will be valuable as naval and air bases, and as cable and radio centers, so at least small garrisons and technical operating forces will have to be maintained on them. Feeding these men is likely to be expensive, for most of these islands are actually desert: they consist either of bone-white coral sand or equally sterile lava and volcanic ash, with little or no soil suitable for gardening. Practically all provisions will have to be shipped in.

Already first moves have been made toward the spread of these soilless gardens to other desert islands that are key points on our transoceanic airways network. A small installation has been set up on Christmas island, just north of the equator and almost due south of Honolulu.

Next on the list is Johnson island, another coral patch a long airplane hop to the southwest of the Hawaiian center. Mr. Blodgett says that area commanders are asking for his gardens faster than he can get them set up, even with the aid of his devoted eleven. It looks as if hydroponics has a promising future in making the desert blossom, if not like the rose, at least like cucumbers and tomatoes.

Anti-Blood Clot Chemical Stops Germs

➤ DICUMAROL, anti-blood clotting substance, also possesses marked anti-germ activity, Dr. Andres Goth, of Southwestern Medical College reports.

Growth of staphylococci, streptococci, anthrax bacilli, undulant fever germs and diphtheria bacilli was stopped by dicumarol.

The anti-germ activity was not stopped by chemicals with vitamin K activity which do block the effect dicumarol has in slowing blood clotting.

Dicumarol was first isolated from spoiled sweet clover. If it could be shown that the spoilage of sweet clover was due to the action of microorganisms, Dr. Goth points out, it would be possible to consider dicumarol one of the naturally occuring antibiotics, such as penicillin.

How to Make Nutrient Solution On a Domestic Scale

Hydroponics in Your Home

Prepared with the co-operation of MAJOR E. W. ELLIOTT, *Chief of the Supply Planning Section, Office of the Air Quartermaster, United States Army, who explained the Army's use of hydroponics installations in Science Service's "Adventures in Science" broadcast over the Columbia Broadcasting System.*

Science has known for a number of years that plants will grow without soil. Soilless gardening is called "hydroponics," and today thousands of men who are fighting on far away battlegrounds enjoy fresh garden vegetables, just like those they might get at home, regularly on their menus thanks to soilless gardening.

How to Set Up a Soilless Garden

A SMALL chemical garden of 3 feet by 6 feet by 10 inches could be constructed for a very little cost by using framing lumber or making the beds of concrete.

In every case the entire inner surface must be coated with a non-toxic seal such as non-toxic asphalt.

Next it is necessary to have some inert media present which can be used as an anchor for the roots of the plant and which will provide aeration. Sand or calcarous gravel could be used but it must be thoroughly washed.

The nutrient solution could be stored in ordinary five-gallon carboys but if a transparent material is used, it must be painted black to exclude light to prevent algae from forming.

A nutrient solution may be made up of the chemicals shown below in approximately the weights shown after each. To these must be added certain trace elements such as iron, fluorine and boron. This quantity is approximately ten times the capacity of the bed, and need not all be mixed at once.

A typical nutrient solution formula is as follows:

Potassium nitrate—6 lbs.
Ammonium sulfate—1 lb.
Magnesium sulfate—4½ lbs.
Mono calcium phosphate—2½ lbs.
Calcium sulfate—11 lbs.
Water—1000 gal.

When this solution has been made up, it is poured into the carboy which is elevated above the level of the tank to permit a gravity flow.

The beds should be flooded to within one inch of the top of the media and this operation should be repeated twice per day at about 12-hour intervals.

One end of the bottom of the bed must be an inch or two lower than the end into which the solution is introduced to permit the solution after flooding the bed to drain into a sump tank. The sump tank may also be of glass, or the interior of this container must be sealed with a non-toxic material.

If the same solution is to be used for long periods of time, testing equipment is necessary to be sure that the above chemicals are present in the proper concentrations. Several soil testing kits which use the colorimetric principle (or color comparison charts) are available commercially for making estimates on these concentrations.

As the plants grow, they may be trained on wires, strings or lattice work and if the sun is too intense a shade may be constructed by using ordinary tobacco cloth.

If these plants are grown indoors, pollinization becomes a problem as no bees are usually present. This problem can be solved by applying growth promoting substances to the flower bloom. This will effect almost one hundred per cent set of the fruit.

If tomatoes are used, these plants should begin to set fruit within about 45 or 50 days and reach full production within 60 days.

When production of a bed begins to drop off markedly, the old plants may be removed and replaced by young seedlings. Then the entire process of plant feeding, described above, is repeated as a new cycle of production has begun.

Tomatoes With Ten-fold Vitamin A

➤ TOMATOES with ten times as much vitamin A value as is contained in varieties now offered on the market may be developed by improved breeding, Dr. F. P. Zschiele of the University of Chicago botany department told the Iowa section of the American Chemical Society.

Such fruit, Dr. Zschiele said, will aid materially in supplying the vitamin A requirements of human beings.

Tomatoes offer unusual opportunities for the study of pigment relationships and for improvement by breeding for high contents of beta-carotene, according to Dr. Zschiele.

The photoelectric spectrophotometer, built by Dr. Zschiele, was used in analyzing the vitamin A, chlorophyll and carotenoids in plants through delicate, intricate measurements with light and absorption curves. Results can often be obtained with this micro method, now available to most laboratories, which cannot be secured in any other way, he pointed out.

"The carotene content of vegetables varies widely, being high in spinach and broccoli leaves, medium in snap beans and peas, and low in lima beans," he explained. "For successful storage, the necessity for blanching has been shown repeatedly. Quick-frozen vegetables retain carotene reasonably well for one year, but losses are heavy during the second year."

Commercial carrot varieties were found to be remarkably uniform in carotene content, but Dr. Zschiele discovered an unexpectedly high content of alpha-carotene. In eggs, the high carotenol content and its close relationship to vitamin A makes analysis difficult. Spectrophotometric study showed that the chlorophyll and carotenoid contents in alfalfa and corn leaves were not affected greatly by certain fertilizer treatments.

Food Supply From Ocean Could Be Increased in South

Artificial Oceans for Raising Fish

➤ SWIMMING off the shores of the southern states is an abundant supply of fishfood, now only partially used, that, with proper development, could furnish the people of these states with an inexpensive diet rich in proteins, carbohydrates, fats, minerals and vitamins. It also could furnish the South with needed chicken feed and fertilizer from wastes, and yield large net incomes from fish and fish products shipped to the North and West.

This is the opinion of Harden F. Taylor, former president of the Atlantic Coast Fisheries Company, expressed at the University of North Carolina's celebration of its fiftieth anniversary. Regional welfare was the general subject of the conference at which he spoke.

The coastline of the southern states stretches about 2,500 miles from the Virginia capes to the Mexican border, but if defined indentations are included, he said, it is about 4,500 miles long.

"While the greater part of the Atlantic ocean is about two miles deep," he continued, "the land does not pitch off suddenly at the shore into the abyss of the ocean. There is an under-water ledge, beginning at the low-tide and gently sloping off-shore to the 100-fathom line which lies about 50 miles to sea along our southern states, and roughly parallel with the shore line."

This ledge area includes roughly 175,000 square miles, and the marine resources of the southern states are mainly on it.

"Considering the large area of sea bottom, and the fact that every square mile of it is a natural food factory," Mr. Taylor added, "the total yield of the fishery has not been and is not now of impressive magnitude, and the South is not making the most effective use of what is produced."

Scientific research is essential if the fishing industry of this area is to be properly developed, he indicated. This must include not only matters having to do with fishing and marketing, but also a biological appraisal of the fundamental productivity of the area.

"Such studies," he said, "might also show that the growth of vegetation in seawater outruns the conversion of that vegetation into animal life, and that vegetarian fishes might be advantageously transplanted from other parts of the world, such as the California or Mediterranean sardine, to increase the total amount of grazing and therefore of fish substance in the sea."

"Many areas of the world," he added, "have valuable species which cannot get here under their own steam, for example the soupfin shark of the Pacific coast, whose livers are the richest known source of vitamin A."

Mr. Taylor mentioned the development of oyster growing in indented bays along the coast.

"A fascinating extension of this general idea," he declared, "is the possibilities of other plankton-consuming marine animal species in enclosed bodies of salt water. If we seal off a salt lake, of, say, a square mile, and supplied the fertilizers necessary to grow plankton, oysters and other plankton eaters would grow rapidly. Such highly prized species as shad, and possibly pompano, might be landlocked and grown for market."

Mother's Atoms In Baby Rat 3 Months Old

➤ EVIDENCE of great economy in the animal body's use of mineral elements is offered in a study by Prof. G. Hevesy of the University of Copenhagen, on "tagged" atoms of artificially radioactive phosphorus in laboratory mice. The research is reported in a testimonial volume celebrating the sixtieth birthday of the noted physicist, Prof. Thé Svedberg of the University of Uppsala, recently published in Sweden.

Prof. Hevesy injected into the bodies of pregnant female mice a solution of a phosphate which had been rendered artificially radioactive, so that the atoms could be detected by suitable apparatus wherever they turned up. After the young mice were born, one was immediately killed and its body tissues analyzed to find how much of the maternal dowry of "tagged" phosphorus had been passed on to it. After three months, when the new mice were full-grown, another was killed and similarly analyzed. It was found that 40 per cent of the phosphorus concentration present in the newborn mouse still remained in the body of its littermate three months later.

In another series of experiments, the radioactively "tagged" phosphorus atoms were traced through three generations. The concentration in the granddaughter mice was found to be six-tenths of one per cent of what it had been in their mothers at birth.

Germ Fighter From Athlete's Foot

➤ VICTIMS of athlete's foot may find it hard to believe, but the fungus that causes them misery produces an anti-germ substance very much like penicillin.

Discovery of the penicillin-like substance in the athlete's foot fungus was made by Dr. Samuel M. Peck and Dr. William L. Hewitt of the National Institute of Health.

The same anti-germ substance, or antibiotic as it is termed technically, was found in a number of other fungi that cause skin trouble, including one that causes ringworm.

It is active against streptococci, staphylococci and pneumonia germs as penicillin is. Like penicillin, its production is enhanced by corn-steep liquor, and there are other similarities between the two antibiotics. The fungi, however, produce their antibiotic in very low concentrations so they are not expected to become a practical source of the material for use in treatment of infections.

Secret of Anti-Tank Weapon is Tungsten Carbide Housed in Aluminum

Carboloy Core Pierces Armor

➤ A PROJECTILE within a projectile is a good description of the Army's newest armor-piercing shell that has a housing of aluminum alloy and a core of the hardest material yet made by man, tough cemented tungsten carbide, instead of steel. It is lighter in weight, too, so that a given gun can fire the artillery projectile with much higher velocity. Reports from the battlefront state that German tanks, like the Panther, Tiger and Royal Tiger, were stopped with single shots at ranges up to 3,000 yards.

In use since the St. Lo breakthrough last summer, the tungsten carbide cores for the anti-tank weapon are now produced in the world's largest tungsten ore reducing plant by the Carboloy Ordnance Division, Natrium, W. Va. Tungsten carbide is harder and heavier than armor plate, therefore a core made with it penetrates steel plate far more easily than a steel core. The extreme hardness of the carbide prevents it from being flattened out on impact. Specimens recovered show the nose of the carbide core to be almost unmarked after passing through several inches of armor plate.

After penetration, however, the core breaks up into lethal pieces, scattering in all directions inside the enemy tank, often causing fires to be started.

The shell consists of two major parts, a housing made of an aluminum alloy that streamlines the shell and permits a smaller diameter armor-piercing core to be fired from a larger bore gun. This housing performs no major function in actual penetration of armor. It does, however, streamline the shell and permit a smaller core to be fired from a larger bore gun. The armor-piercing energy is largely concentrated in the second major part, the small-diameter tungsten carbide core. As an example, in the 76 millimeter projectile, half the weight of the projectile is contained in the carbide core, the total weight of the unit being about nine pounds, compared with the weight of 15 pounds for the conventional steel armor-piercing projectile. As a result, the muzzle velocity of the projectile is about 3,400 feet a second as compared with 2,800 feet a second for the steel projectile. With this higher velocity, lighter total weight and shorter flight time, accuracy of fire is increased, making the shell more effective.

Due to the relative scarcity of tungsten carbide and the critical need for its use in speeding tank production by enabling the machining of armor plate with far greater ease than is possible with steel tools, it was not until the war reached the continent of Europe that it was used in the cores of anti-tank projectiles. Thus the metal which helped build U. S. tanks was used to destroy enemy tanks.

Several new processes had to be developed before it was possible to produce tungsten carbide cores to Army

weight and size specifications. Among these processes, developed by the Carboloy Company, is a method of turning out the cores without grinding. This is particularly important, since diamond-impregnated wheels are almost the only tools that can be used to cut this tough hard metal. A way was also found to substitute more readily available nickel instead of critical cobalt for the binder in making the core composition. Another process makes it possible to use scrap tungsten carbide in core production, in a similar way to the salvaging of steel and aluminum alloy scrap.

Detect Raw Milk in Cheese

➤ A PRACTICAL METHOD for readily determining whether the milk used in making Cheddar cheese was pasteurized has just been developed by dairy experts of the U. S. Department of Agriculture. The addition of as little as 0.1% of raw milk to properly pasteurized milk, or a decrease of two degrees in the pasteurizing temperature for 30 minutes, can be detected by this new, improved test, a modification of the phosphatase test commonly used in testing milk for adequate pasteurization.

Although laws in various parts of the United States restrict the sale of raw milk for drinking, only a few states such as California, Illinois, Indiana and New York require that all cheese sold be made wholly from pasteurized milk, or that the cheese be cured for a definite period of time prior to its sale. Outbreaks of various diseases such as typhoid fever and undulant fever have been attributed to the consumption of cheese made from unpasteurized milk and cured for only short periods of time.

The new method for detecting the use of unpasteurized milk products in cheese was developed by Dr. George Sanders and Oscar S. Sager of the Bureau of Dairy Industry, and is based on the fact that the enzyme phosphatase, present in raw milk, is destroyed when milk is satisfactorily pasteurized.

In the test disodium phenyl phosphate is added to the cheese to be tested. If any phosphatase is present, it splits this organic phosphate, liberating phenol in proportion to the amount of phosphatase activity present. A reagent is added which, reacting with the phenol, develops a rich blue indophenol color. A scale of standard colors, prepared with known amounts of phenol, is used to measure the amount of phenol liberated, and thus the test shows the amount of unpasteurized milk product present or the extent of underpasteurization of the milk used.

More than 340 samples of Cheddar cheese, for which records of the treatment given the milk were available, were tested by this method. All samples of cheese made from raw milk or underpasteurized milk were detected, regardless of the age of the cheese.

Dog gas masks have been perfected to use on Army dogs when necessary to protect them against chlorine, phosgene, and other choking gases used by the enemy.

Researches Point Way to Understanding Mental Disease and Cause of Aging

Anti-Fatigue Chemical Studied

➤ AN ANTI-FATIGUE chemical, and new light on the problems of cancer, mental disease and aging, may come from researches going on at a new scientific institution at Worcester, Mass. It is the Worcester Foundation for Experimental Biology, non-profit and educational institution supported in part by the community of Worcester and Worcester County and in part by grants from philanthropic foundations, industry, government agencies and private individuals.

Director of the new institution is Dr. Hudson Hoagland. Dr. Gregory Pincus is director of the Foundation's laboratories.

There is also hope of increased meat production. More steaks and chops will not be available immediately as a result of the Foundation studies. The experiments have not yet reached so close to practical application. They illustrate, however, one of the tenets of the Foundation, that the same sort of advances in health, nutrition and medicine will come from fundamental research in biology as the great advancements in modern engineering which were based on understanding and application of basic physical and chemical principles.

The physiology of the development of mammalian eggs and embryos and the regulation of reproduction by hormones have long been studied by some of the personnel of the Foundation's staff. They are continuing this work in the direction of attempting to produce multiple young per birth in domestic animals—experiments which if successful would make possible substantial increase in the world's meat yield.

Hormones, the chemicals produced by the endocrine glands of the body, are being extensively studied in other aspects of their effects on living beings.

In a study of mental patients, coordinated changes in electrical brain wave activity and hormone reactions have been found to accompany changing psychiatric reactions in the patients.

Possibility that the acute fatigue suffered by patients with certain types of mental and emotional disorders may have a glandular basis is suggested by another series of investigations of hormone physiology.

This work started with the finding by the Worcester group that excretion via the kidneys of certain types of hormones or chemicals derived from them, is different in persons suffering from cancer than in healthy persons.

Later it was found that excretion of these chemicals which are derived from adrenal gland hormones, is greater in men who suffer most from fatigue when working under stress. This showed that the ability of men to withstand fatiguing ordeals is related to the functioning of the adrenal gland cortex.

The Worcester scientists next searched for a way to offset this. They found it in a synthetic chemical, pregnenolone. Daily doses of this resulted in improved target meter performance by healthy young men working under simulated flying conditions and improvement in production rates and waste savings by factory workers in operations involving incentive piecework pay.

Scientists at the Foundation are slowly accumulating information about hormone action as a function of age which may help to prolong man's useful years.

"Haven't you finished with the baby's formula yet?"

Waterproofing Process Tried for Mercury Containers in Mexico

Rubberized Cloth Used Early

➤ RUBBERIZED CLOTH is much older than commonly supposed, it is revealed in a document published by the Middle American Research Institute of Tulane University, with the cooperation of the Firestone Tire and Rubber Company. The document is a translation of an old Spanish manuscript found in Mexico and now in the library of the Institute, an organization which specializes in the archaeology of Central America. It records experiments with rubber conducted from 1785 to 1798, preceding MacIntosh by several decades.

Waterproofing fabrics with rubber is generally supposed to be an invention of a Scotchman, Charles MacIntosh, from whom the well-known rubberized raincoats called mackintoshes are named. His process was first announced in 1823. The recently discovered manuscript shows that in 1785 rubberized cloth already had been known "for years, perhaps generations."

The manuscript is a report on experiments, ordered in Spain and carried out in Mexico, in an effort to find a leak-proof container for mercury shipped from Spain to gold mines in Middle America. Chamois bags were being used but the loss from leakage was high. A Don Silvestre de la Vega carried out the research work in Mexico and developed a satisfactory bag by placing a rubber bag inside a chamois bag, another rubber bag over this combination, and a second chamois bag over all three.

The possible use of rubber for this purpose was suggested in the instructions from Spain. One part of the newly discovered manuscript contains all the data available in Spain about rubber at that time.

The origin of the Spanish interest in rubber is uncertain, but there is a story believed by many to the effect that Columbus, on his second voyage to the Western Hemisphere, brought back a rubber ball used by American Indians in their sports. The story says the ball was made from the sap or juice of a tree and that it bounced unbelievably, or words to that effect. It is believed by American archaeologists that Indians, before white men came to the continent, made not only rubber balls but rubber footwear and water containers as well.

A portion of the manuscript declares that from rubber-treated strips of cloth "are cut the desired pieces for making capes, small cloaks, riding packs, sleeveless cloaks, boots, shoes, carriage tops, outside coverings of boxes of paper, or packages for other effects, with the assurance that even though the packages contained in these covers by chance should fall into water and remain there many days, no penetration, infiltration or soaking will occur."

Radar Oscillator Plates And Green Diamonds

X-Rays Alter Properties of Crystals

➤ PRACTICAL APPLICATIONS of a new basic discovery, in which X-rays and other radiations are used to alter the elastic constants and chemical properties of quartz and other crystalline substances employed in radio and radar oscillator-plates to regulate wavelength, were demonstrated to a group of scientists recently at the Reeves-Ely Laboratories in New York by Dr. Clifford Frondel, head of the company's research division.

Another interesting application of X-ray found in the course of Dr. Frondel's work is its use in changing the color of many gem stones. Some colorless stones of little value may be given intense hues. Diamonds have been colored green and golden brown with deuterons, but the cost of the treatment is large and the results frequently unpredictable, so that the method is not yet of much commercial value.

Dr. Frondel discovered recently that X-rays, and certain other types of radiation cathode, or electronic, rays and deuteron beams from a cyclotron, when allowed to pass through plates cut from certain crystalline substances, alter the mechanical strength of the material. There are accompanying changes in the color of the crystals, and their chemical reactivity also may be altered.

The X-rays or other radiations cause an interchange of electrons, Dr. Frondel explained, between the atoms composing the crystal and, by thus altering the interatomic bonding forces, change the elastic constants of the material. The effect is similar to the action of visible light in blackening photographic emulsions.

The discovery is of great theoretical interest from the viewpoint of pure science, but has already been put to practical use in the war effort. Millions of tiny plates of crystalline quartz, the size and shape of postage stamps, are used by the armed services as oscillator-plates to control radio communications. The frequency at which the radio will transmit or receive, he reminded his hearers, is controlled, in common types of crystals, by the thickness of the plate. They are brought to proper thickness by mechanical means, and the process is an extremely delicate operation.

By using the new X-ray irradiation technic, oscillator-plates can now be adjusted rapidly and easily, he said, to a desired frequency with a precision hitherto impossible.

Irradiation with X-rays, he stated, also has been found to modify greatly the rate of solution and the chemical reactivity of crystals. A whole new field of X-ray photochemistry is being opened up by his research.

Waterproof matches, developed for use in jungle areas and at sea, will light after being submerged in water for many hours.

Chem Quiz

Who, When and Where?

➤ HERE IS a list of names outstanding in the history of chemistry. Some of these men you may have met. Some you may never have heard of. Some you may find hard to distinguish from certain others. Their life-dates are in the second column. Can you match the dates and names? For your enlightenment, the identifications are on page 41.

1. Baekeland	*a.* (372-287 B.C.)
2. Berthelot	*b.* (3rd or 4th century A.D.)
3. Berthollet	*c.* (9th century A.D.)
4. Berzelius	*d.* (1490-1541)
5. Boyle	*e.* (1577-1644)
6. Carothers	*f.* (1604-1668)
7. Davy	*g.* (1627-1691)
8. Gibbs	*h.* (1733-1804)
9. Glauber	*i.* (1748-1822)
10. Kekulé	*j.* (1777-1857)
11. Moissan	*k.* (1778-1829)
12. Paracelsus	*l.* (1779-1848)
13. Priestley	*m.* (1827-1907)
14. Remsen	*n.* (1829-1896)
15. Rhazes	*o.* (1839-1903)
16. Smith	*p.* (1846-1927)
17. Thénard	*q.* (1852-1907)
18. Theophrastus	*r.* (1852-1911)
19. van Helmont	*s.* (1856-1928)
20. van't Hoff	*t.* (1863-1944)
21. Zosimos	*u.* (1896-1937)

Pharmacopoeia Demotes Latin

➤ DOCTORS may still write their prescriptions in Latin, but when they look up a drug in the Pharmacopoeia, they want to find it under its English name. Consequently English titles will take first place, Latin titles second place in the new U.S. Pharmacopoeia, scheduled to appear in December 1945, according to an announcement from Dr. E. Fullerton Cook of Philadelphia, chairman of the U.S.P. Committee of Revision. Although medical members of the Revision Committee have been the chief advocates of this change, other users of the Pharmacopoeia besides physicians are expected to benefit, since the new style makes possible the grouping of related products in one place.

At present digitalis preparations, for example, are scattered through the book under class names such as Capsulae, Injectio, Tabellae, Tinctura, and the like. This resulted from the style of putting substances in alphabetical order under their Latin titles. The person looking up digitalis capsules had to hunt under Capsulae through all the other kinds till he came to Capsulae Digitalis. Then if he wanted to compare these with requirements or standards for digitalis tablets, he had to search under Tabellae. With the new style, he will merely look for digitalis. All U.S.P. digitalis preparations will be grouped there in alphabetical order.

The Latin titles will not be dropped, but will be placed after the English titles.

Iron, Vanadium and Titanium Float Above Glowing Hydrogen

Cool Metallic Clouds In Variable Star

by Robert S. Richardson
Mt. Wilson Observatory

➤ Increased light-efficiency of the 100-inch reflector, due to faster photographic plates and to optical apparatus of improved design, has enabled astronomers of the Mt. Wilson Observatory to obtain large-scale photographs of the spectra of certain red stars which confirm and extend a hypothesis advanced nearly half a century ago. The results of the investigation have just been announced by Dr. Paul W. Merrill in the Publications of the Astronomical Society of the Pacific.

Light from most stars, when spread out into a rainbow-colored band or spectrum, is found to be crossed by a series of dark lines due to hydrogen gas in their atmospheres. The first line of the series is in the red, the second in the blue, the third in the violet, etc., the strength of the series decreasing in a regular way from red to violet.

In many red variable stars, however, the hydrogen lines, instead of being dark, are bright during a part of the cycle of luminosity of the star. A most puzzling feature is the irregular strength of the lines, the series having what Dr. Merrill describes as a "mutilated" appearance, which is without counterpart in any other type of star.

For years it has been known that the surface of these stars is covered by cool clouds of metals, such as iron, vanadium, and titanium. These clouds partially absorb the light emitted from the hot hydrogen gas below them, thus producing many of the observed irregularities in the strength of the bright lines.

Confirmatory evidence to this effect was supplied by comparing the structure of certain ultraviolet bright hydrogen lines in the spectrum of the red variable star, Omicron Ceti, with the spectrum of the red star, Beta Pegasi. The spectrum of Beta Pegasi closely resembles that of Omicron Ceti except that it lacks the bright hydrogen lines. The comparison revealed close agreement between depressions in the bright hydrogen lines in Omicron Ceti and dark lines due to metals in Beta Pegasi, conclusive evidence that the mutilated appearance of the series is due to the influence of cool metallic clouds which must lie above the glowing hydrogen.

A mystery still unsolved is why hydrogen gas shines so brightly in red variables like Omicron Ceti which are among the coolest known stars, having a surface temperature estimated at only 4,000 degrees Fahrenheit. To make hydrogen shine requires some special source of energy supply which astronomers have not been able to identify. Dr. Merrill believes the changes in strength of the bright hydrogen lines are closely connected with the mechanism causing the variations in the brightness of the star as a whole.

Unknown Protein Reaction Causes Ragweed Sensitivity

Growths of Evil

by Dr. Frank Thone
Science Service Biology Writer

➤ Is'nt it odd that most of the hayfever cases in this country are due to the pollens of just two closely related weed species!

Ragweeds are getting fairly into bloom about now, over the northern part of their range. As their waves of windborne pollen sweep southward to the Gulf, the sorrowful season of sneezes and bleary eyes comes on for thousands of hayfever sufferers. There will be no real letup until frost, for even though many municipalities conduct summer weed-mowing campaigns, ragweed pollen grains are so light that they float for miles on the wind, and there are plenty of sources out in the country to keep the air of even the largest cities most dolefully contaminated.

Why ragweeds should bear the responsibility for nine-tenths of summer hayfever cases is still more or less of a mystery. To be sure, there are enormous quantities of both tall and low ragweeds, and both species are prolific producers of pollens. However, other windborne pollens, such as pine and spruce, are often much more abundant than ragweed pollen, at least in certain regions, yet these tree species seem to cause few if any cases of hayfever. There simply seems to be some specific malignancy in the ragweed pollen itself—some quality in its protein that makes it easier for human mucous membranes to react to it in that still-mysterious chemical behavior known learnedly, but not at all understandingly, as sensitization.

This touchiness of many persons' respiratory tracts to ragweed pollen has made ragweeds a profitable crop for at least a few hardy-nosed individuals. They hand-harvest quantities of it for a few pharmaceutical manufacturing concerns that use the pollen in immunizing preparations—more or less on the hair-of-the-dog-that-bit-you principle. A number of other hayfever-causing pollens are similarly harvested, but the most important by far are the ragweed pollens.

Hayfever is very definitely a disease of civilized communities. So long as our country was in the pioneer stage of development there was far less hayfever than there is now. Ragweeds do not thrive at all in the forest, and did but ill on the unbroken sod of the virgin prairie. They are primarily weeds of disturbed soil, growing most lustily

on neglected road-edges and in ill-cultivated field-corners. The low ragweed also springs up in cut-over or burned-over forest areas, and in overloaded pastures where the sod has been gnawed and trodden thin. So if we complain of these bad neighbors, the ragweeds might readily answer us, "Well, it's your party—you invited us!"

Japanese Mask Generates Its Own Oxygen

➤ A STRANGE TYPE of oxygen mask that generates its own oxygen by electricity is part of the standard equipment of the Mikado's troops. Translation of instruction plates from an oxygen mask forwarded to the Air Technical Service Command at Wright Field reveal how the unique device works. Oxygen masks used by American troops and flyers in high-altitude B-29 Superfortresses and other planes use compressed oxygen prepared at mobile oxygen-generating plants and stored in metal cylinders until needed.

One of the Japanese systems consists of six units, a battery, two electric buttons, a container for the oxygen generator, a gas meter, the mask and rubber tubing connecting the generator, meter and mask. Two special chemical oxygen generators are inserted in the container, which is fitted with a metal door opening at the top. When ready for use, one of the electric buttons is pressed down, igniting the generator. Oxygen begins to flow in five seconds. After generation has once started it does not stop for 75 minutes. By using both generators, enough oxygen to last a man for two hours is produced. The meter tells the Nip fighter how much oxygen he is getting.

The Japanese also use the compressed gas system, and the chemical system may be used as an auxiliary.

Transparent Steel Film in Aerial Photography

➤ VERY THIN FILMS of stainless steel, which have a degree of transparency, placed in front of the wide-angle lenses used in aerial photography, furnish the solution to a former difficult problem. Heretofore in using wide-angle lenses a "hot spot" in the center of the field of vision resulted in pictures bright in the middle but dark at the edges.

Scientists of the Bausch and Lomb Optical Company developed a vignetting filter consisting of a disk of optical glass on which a film of stainless steel was deposited by a special electro-vacuum precipitation process. Placed in front of the lens, the film is thickest and transmits least light at the center of the disk, becoming gradually thinner and more transparent toward the edge. By complementing the characteristics of the photographic lens with which it is used, the filter permits photographs of ordinary density distribution.

Chemical Things To Do:

Juices Detect Acids or Alkalis

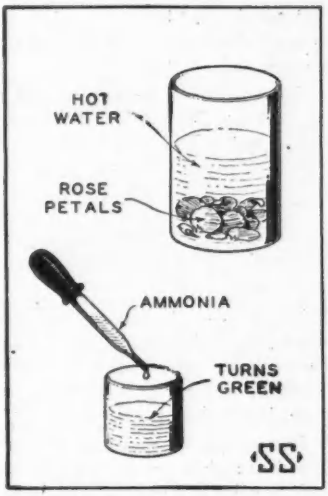
by Joseph H. Kraus

A solution can be tested to determine if it is acid or alkaline by merely dipping a small strip of litmus paper into the liquid, but such specially-prepared paper is seldom handy when needed. Extremely sensitive indicators for acids and alkalis can be made from flowers or vegetable extracts.

The junior scientist can prepare a host of various-colored solutions and test them to determine which is the most sensitive. The colored solutions in general are made from the juice of fruits or berries, from alcoholic extracts, by boiling flowers or vegetables in water, or by merely steeping them in hot water.

A red rose may be used in making a typical test liquid. Place a quantity of petals from the red rose in the bottom of a drinking glass. Pour a little hot water on these and allow to steep until the liquid takes on a distinctly red color. This solution may be used as a test for an alkali or an acid. Add a small quantity of household ammonia to it. The color will become green. Add a small quantity of acetic acid or white vinegar and the solution will become pink again.

Boil blue iris flowers in water, and use the blue solution for testing. It will become green with alkalis, red with acids and stay blue when neutral. Hydrangea flowers are extremely sensitive to acids and bases. In fact, the color of this flower can be changed on the bush by adding acid sodium phosphate or lime to the soil. You can produce variations of color on the same bush merely by treating the soil around each half of the bush with different chemicals.



The juice of ripe elderberries will turn red with acids; it will take on a shade ranging from blue to green with alkalis. Red cherry juice will be red only when somewhat acid; it turns green with alkalis.

Soak Cabbage Leaves

Soak the leaves of red cabbage in water. Dip clean white filter paper, face tissue, blotting paper, or toilet tissue in this solution and cut into strips. Now when you want to test a

solution, dip an end of a strip of this paper into the liquid just as you would litmus paper. It becomes green with alkalis, red-violet with acids.

Make a very strong tea and dip paper into this. It will turn brown with alkalis and become black if any iron salts are present in the solution being tested.

You can test your garden soil in this fashion. Bore out a small quantity of soil by pushing a metal tube into the ground. Saturate with distilled water the earth you have collected. Catch the drippings, then test with paper.

By following the technique given, you can prepare a great many vials of colored solutions and colored papers, some of which will change when as little as a single drop of vinegar is added to a pitcher of water. The colored solution or paper will prove to be much more sensitive than the taste buds of your tongue for you can drink this water without being aware of the fact that any acid is present.

New Tent Cloth Better Than Prewar Duck

▶ TENT CLOTH has been developed which, through the use of new synthetic resins, wears longer, has greater strength, and resists weathering and fungi better than prewar duck.

The compound in which the cloth is bathed makes it waterproof by sealing the relatively open weave. By acting as a binder and carrier for the flame-proofing and fungus-resisting agents, it protects the cloth against fire and deterioration.

A group of resins known as the paraplexes were used to coat the canvas, which remains flexible at sub-zero temperatures. These resins, one of a group of tacky, adhesive resins made from unsaturated fatty acids and glycerol, are more rubbery and non-oxidizing than the oil-modified type.

A rosin-modified phenolic resin was used to carry the pigment. It possesses a high melting point, intrinsic hardness, and releases solvents rapidly, of particular importance to the manufacture of tent cloth.

In all, over ten different ingredients were used in carefully controlled quantities.

In the early stages of the war, mildew destroyed one-fifth of all fabrics shipped to the South Pacific. The wide range of weather and service conditions found in various theaters of war called for a material that would remain flexible at sub-zero weather, be completely water- and weather-proof, and retain color well. Already familiar with synthetic resins from their earlier experience in making book cloth and artificial leather, the L. E. Carpenter Company, with the coöperation of the Resinous Products and Chemical Company, devised a coating compound for tent cloth that would fill the bill.

By unrolling the fabric as it comes from the textile mills and stitching the end to another roll, a continuous coating operation has increased the output 40 per cent.

▶ AMMONIA LEACH VATS, *where nickel is wrested from low-grade ores previously regarded as worthless for commercial use, are an important part of the plant located at Nicaro, Cuba.*

Low-Grade Ore Yields Nickel

▶ METALLURGISTS are performing one of the neatest feats of the war in Nicaro, Cuba, by wresting critically-needed nickel from low-grade ores which once were valued only as substrata support for Cuba's eye-pleasing landscape.

It's all done with the ammonia leach process, which extracts the metal in oxide form from ores containing only about 1.5% nickel. Low-grade ore had never been exploited to advantage until the Freeport Sulphur company built a plant in Nicaro for the United States government, to utilize the process perfected by their metallurgists.

Low-grade deposits that blanket this area alone will supply the $33,500,000 plant enough ore to produce annually 42,000,000 pounds of nickel oxide, containing 32,000,000 pounds of nickel, according to Donald B. Mason, company technical director. This assures the United States a dependable source of its own of this vital war

Chile is planning to establish tung-tree orchards to produce tung oil for domestic uses; tung orchards in neighboring Argentina are successful.

metal for the first time, he asserted.

Nickel oxide is being produced today at the rate of 28,000,000 pounds a year in the plant which was rushed to completion when the United States' nickel stockpile was dangerously low. That is equivalent to about 10% of the Allies' production of nickel metal.

The Nicaro process, which was developed by M. F. Dufour and R. C. Hills, both Tulane University graduates on the Freeport Sulphur engineering staff, consists first of driving most of the native water out of the ores by heating in rotary driers, then grinding to obtain uniformity in the material before it is subjected to roasting and reducing. In the roasting, the ores decompose into water—which is evaporated—nickel oxide and iron oxide.

The reduction, which takes place simultaneously with the roasting and must be closely controlled, converts the nickel oxide to metallic nickel without at the same time converting the iron oxide to metallic iron. Emerging from the furnace, the metallic nickel and iron oxide are quenched immediately in an ammonia solution which literally dissolves the nickel as though it were sugar in coffee, at the same time permitting the iron oxide and other insoluble elements to settle in the solution.

The next step is a distillation process in which the ammonia is boiled off for recovery and reuse, with precipitated basic nickel carbonate resulting after the distillation. Water is removed from the dilute suspension of nickel carbonate in thickeners and filters, and the resulting thick mud passes to a rotary kiln where the remaining water is driven off and the carbonate is converted to oxide by "cracking" off carbon dioxide which is recovered for reuse.

Coating for Gunpowder Speeds Flame Spread

A new coating for gunpowder that causes an almost instantaneous firing of the charge has been developed at the Ordnance Research and Development Center, Aberdeen Proving Ground, Md.

The coating cuts the ignition time so that the spread of flame through the powder is almost instantaneous, at the moment the charge is fired. Heretofore, the charge has burned from one end to the other, beginning at the primer cap and progressing towards the forward end of the charge.

In a demonstration, equal quantities of powder were placed in two test tubes. One of the charges of powder was coated, the other uncoated. Two small balsa wood "bullets," of equal size, shape and weight, were dropped in on top of the charges. A gas flame was held under the two test tubes, so that the heat set off the powder. The bullet shot from the tube containing the uncoated powder sluggishly, made it to the mouth of the tube, managed to go a foot or two into the air, then dropped to the ground. The bullet from the coated powder gun snapped out of the test tube and traveled nearly five times the distance of the other bullet before it fell.

New Register of U. S. Patent Office Announces Patents for Sale or License

Available Patents Listed

➤ A NEW service to American inventors and businessmen is being offered by the U. S. Patent Office. A register of patents available for licensing or sale is being published in the weekly Official Gazette of the Patent Office, to help establish contact between manufacturers looking for good and profitable articles to make and inventors or owners of unexpired patents on such gadgets. This service is expected to be especially useful to small manufacturers.

Procedure is of the simplest. Formalities are wiped out altogether. There are no blanks to fill out, no questionnaires to answer. All the patent owner needs to do is write an ordinary letter to the Patent Office, giving the number of the patent he owns and attaching a printed copy, and stating that he is willing to license or sell same on reasonable terms. If he doesn't happen to have a copy of his patent on hand, he can attach an order for a copy, enclosing a dime to pay for it.

If he cares to state definitely the terms on which he will license or sell, they will be included in the statement in the Register; otherwise the "reasonable terms" clause will leave him free to drive his own bargain with the licensee, either directly or through an attorney or other agent.

Likewise free of formalities are the brief abstracts prepared in the Patent Office as guides to possible licensees. The interminable, and often unintelligible, technical jargon in which patent attorneys usually couch patent claims is all tossed overboard, and the essential nature of the device offered is set forth in a score or so of words in plainest English. A sample: "Book-type toilet kit or the like with clamp inside so arranged that clamp acts as support when case is open and in use."

In publishing this register of licensable patents, the Patent Office is not assuming any responsibility to either the patent owner or the licensee. On the one hand, it does not guarantee the practicability of any invention; on the other, it offers the patent owner no assurance of the business standing of the would-be licensee. The suggestion is offered that the owner use "methods any prudent individual might observe, such as credit reports, business ratings, etc."

The Patent Office is undertaking one further service: It is setting up classified mailing lists for businessmen interested in specific types of inventions as they are added to the new Register. Thus, if a manufacturer is interested in, say, shoes, or fountain-pens, or coffee percolators, or flashlights, he will ask to have his name placed on the appropriate mailing list. Thereafter he will receive notices of such patents as are listed in that particular category, without having to wade through a lot of descriptions about which he cares nothing.

Copies of the Register will be sent regularly to trade journals, for publication if they so desire. Even the preliminary notices that appeared in only a few such publications have already resulted in something over 100 inquiries from interested manufacturers.

Among the patents with chemical subject matter or angles are the following:

Chemical Patents of the Month

Improved Chromium Plating

➤ BETTER and brighter chromium plating on postwar automobile trimmings and household metalware may be looked for as the product of a new electroplating method on which Charles G. Harford of Quincy, Mass., has obtained patent 2,377,229. Greater safety for workmen in the plating shop may be expected, too, since the method substitutes ethylene diamine or some other relatively non-poisonous compound for the highly toxic cyanide hitherto used in the plating bath. Patent 2,377,228, covering a similar process applied to cadmium plating, has also been granted to Mr. Harford. Rights in both patents are assigned to Arthur D. Little, Inc.

Coal by Flotation

➤ A FLOTATION process, essentially similar to that used in concentrating metalliferous ores, is used in reducing the ash content of coal, in a method on which patent 2,376,703 was issued to F. L. Kuhlwein of Essen, Germany. The patent is vested in the Alien Property Custodian, from whom license to use can be obtained upon payment of a small fee. "Refinement" of the coal proceeds in two steps. First, the coal is ground fine and poured upon a liquid of high specific gravity. The purer coal particles float; those with high mineral content sink. Then the coal, after perhaps a further pulverization, is put through a froth-flotation process.

New Transplanting Tool

➤ A NEW transplanting implement, that also gives the young plants a thorough treatment with insecticidal dust to protect them against pests in their first critical days outdoors, is the invention on which patent 2,376,970 was awarded to W. W. Keown of San Leandro, Calif. It consists essentially of an open-bottomed cylinder with a handle. Pushed over the young plant, it lifts it out of its growing bed with a block of soil around its roots. Pressed into place in the garden, it sets out the plant. A turn of the handle then releases a piston, which sucks in enough outside air to swirl a cloud of insecticidal dust out of a reservoir and thoroughly cover the foliage.

Stainless Steels

➤ COLD-WORKED stainless steels composed of manganese, chromium and iron, all of high-degree purity, are covered by three patents, Nos. 2,376,867 to 2,376,869 inclusive, obtained by Dr. Reginald S. Dean, assistant director of the U. S. Bureau of Mines. Success in production, Dr. Dean states, depends to a considerable extent on keeping the alloys free of the oxides of silicon, aluminum and carbon.

Prevents Blood Clot

➤ SODIUM HEPARINATE, a drug used to prevent blood clots in such critical ailments as thrombosis, is prepared according to a new formula under patent 2,377,016, granted to Dr. M. H.

Kuizenga of Kalamazoo, Mich., and assigned to the Upjohn Company. Animal tissues containing heparin are subjected to a process of self-digestion, the heparin is separated out first as barium heparinate, which is then converted into the sodium salt and precipitated out with acetone.

Yeast Process

➤ YEAST has been coming to the fore, of recent years, as a cheap source of protein for feeding to animals. On an improvement in preparing a yeast-molasses mixture, patent 2,377,008 has been granted to the late Herman Heuser of Evanston, Ill., represented by his executrix, Irene B. Heuser. Having discovered that the fermentation-causing enzymes in yeast rendered the mixture unsuitable for feeding to livestock other than swine, Mr. Heuser remedied the situation by heating it to a temperature of about 68 degrees Centigrade.

Excelsior Planks

➤ THAT NEW house you are going to build as soon as the war is over may be made of excelsior instead of solid boards and planks sawed out of big logs. A process for making planks out of excelsior and Portland cement has just been patented here by Armin Elmendorf of Winnetka, Ill.

The excelsior, which may be made from such cheap, low-grade timber varieties as cottonwood or aspen, is first immersed successively in sodium silicate and calcium chloride. These chemicals react together to precipitate calcium silicate on the fibers; common salt, the other product of the reaction, is removed by washing. The excelsior is then mixed with a concrete slurry, molded to the desired dimensions, cured for a suitable period in a moist room, and set aside to dry. Rights in Mr. Elmendorf's patent, No. 2,377,484, are assigned to the Celotex Corporation.

Magnesium Furnace

➤ A NEW-TYPE furnace for extracting magnesium from its ores is put forward by William S. Bowen of Westfield, N. J., for patent 2,377,478. Its essential elements are a series of heating rods or bars of highly refractory silicon carbide tile, set transversely in a shaft made as nearly airtight as possible. A temperature between the melting and vaporizing points of magnesium is maintained, preferably by electric heating.

Finely powdered magnesium oxide, obtained either from the sea or from a rocky ore such as dolomite or magnesite, is mixed with powdered coke and fed in through a hopper at the top. As the mixture sifts down over the heating bars, the coke takes the oxygen away from the ore, and since air is excluded the liberated magnesium cannot re-oxidize. It falls in a molten shower into a pit at the bottom, from which it can be drawn off as desired.

Distilling Oil Shale

➤ A STEP nearer to preparation for that long-threatened day when the last oil-well runs dry is represented in patent 2,377,518, granted to E. H. Records and J. E. Louttit of Tacoma, [illegible] on a still for extracting the oil from oil shale. Instead of simply "frying" the oil out of the shale, which they state results in a relatively inferior product, they add powdered coal or lignite to the charge, and at an appropriate moment in the distilling process

also spray in some oil. The hydrocarbons added by these auxiliary charges, they state, combine with the oil vapors from the shale to give a much better grade of oil.

Glycerin Recovery

➤ THREE BRITISH chemists, E. H. Brittain, W. P. Joshua and J. M. Whitmarsh, of Epsom, England, have received patent 2,377,306 on a process for recovering glycerin from distillery wastes by adding alcohol or other solvent, then boiling it off again while violently agitating the mixture. The solvent is condensed for re-use, while the solid impurities are precipitated, leaving relatively pure glycerin in the vessel.

Food Protecting Paper

➤ TWO PATENTS having to do with food products have been issued to Sidney Musher of New York City. One of them, No. 2,377,359, is on an antioxidant paper impregnated with hydroquinone or a similar compound, to be used for wrapping fats or foods containing fats, such as cakes or wafers. The inventor states that mere contact with the edge of a wafer will protect it against spoilage. The other patent, No. 2,377,360, is on a dry food product made by mixing dehydrated alfalfa with molasses and reducing the whole to powdered form.

X-Ray Analysis Apparatus

➤ QUARTZ CRYSTALS for use in electrical instruments may be quickly and accurately examined in an X-ray analysis apparatus, patent 2,377,862, Walter L. Bond, Brooklyn, N. Y., patentee. The patent has been assigned to the Bell Telephone Laboratory of New York. The device is described as a compact, cohesive and unitary analysis apparatus. It may be used for other purposes as well as the examination of quartz crystals although it is particularly applicable to that use.

In it the various elements of an X-ray analysis apparatus are arranged in an assembly on a single base. By use of what is called a tolerance lever crystals under test may be moved in each of two directions from the selected adjusted position. By another movement, independent of this, the crystal supporting means may be slightly adjusted as desired to assist in the examination.

Synthetic Soybean Wool

➤ PATENT 2,377,885 was given Oskar Huppert of Chicago, who has assigned it to the Glidden Company of Cleveland, for a process of manufacturing synthetic wool from soybean protein. His process for producing the artificial fiber consists of spinning an alkaline solution of soybean protein into a coagulating acid bath. The inventor claims an improvement in the preparation of the spinning solution consisting of hydrolizing soya protein with pepsin in a hydrochloric acid solution whereby the degree of dispersion of the protein in the hydrochloric acid is increased. No decomposition beyond the acid albumen stage takes place, and an alkaline solution is formed. This is aged before spinning.

Penicillin-Like Actinomycin

➤ JUST AS SULFANILAMIDE, the sulfa drug, was joined by a considerable family of chemical cousins within a few years of its original discovery, so now we may expect related extracts from earth-dwelling molds to join penicillin, the first widely publicized and used germ-stopper of that origin.

One such compound, known as actinomycin, together with a method for extracting it, is the subject of two new U. S. patents just issued here, and assigned to Merck and Company, Inc., a pharmaceutical firm very active in the production of penicillin.

The first patent, on the mold chemical itself, is No. 2,378,876, taken out by Prof. Selman A. Waksman of Rutgers University and Dr. Harold B. Woodruff, scientist in Merck's employ. Actinomycin, as they describe it, is a red substance left after a mold known as *Actinomyces antibioticus* has been subjected to ether extraction and the extract then evaporated. It can be chemically separated into two fractions, designated respectively as A and B. Actinomycin A is stated to be especially powerful in its action against certain microorganisms.

The second patent, No. 2,378,449, was granted to another Merck employe, Dr. Max Tishler, and covers an improved method for extracting Actinomycin A.

Better Sun Goggles

➤ ANOTHER eminent scientist, Prof. Walter R. Miles, Yale University psychologist, offers a notable improvement in glare-reducing goggles for patent 2,378,493, rights in which he assigns to the Research Corporation of New York.

A dilemma that confronts persons who have to look squarely at the sun, for example airplane spotters, lies in the fact that if the glass is made dark enough to cut out the direct sun glare and permit objects to be seen against its disk, all the surrounding sky seems black and nothing can be seen against it. Prof. Miles gets around this by giving most of the lens only a "light smoke," while over the center, directly in front of the pupil, he puts a very much darker narrow patch. By making the patches oblong, and setting them at right angles to each other, he gives both pupils complete glare protection, yet permits objects very close to the sun to be seen by at least one eye. Other purposes for which the goggles can be worn, he suggests, are for the penetration of colored camouflage, and for better observation of welding operations.

Diesel Ignition Improved

➤ IMPROVING the ignition qualities of diesel fuels by the addition of what might be called mild-mannered cousins of TNT is the at first startling proposal that won patent 2,378,466 for Dr. George O. Curme, Jr., chemist in the laboratories of the Carbide and Carbon Chemicals Corporation, to which firm he has assigned rights in his invention.

TNT, nitroglycerin and other high explosives are trinitrates of carbon-containing compounds. To pep up the often sluggish ignition of diesel oils, Dr. Curme adds small percentages of the dinitrates of either polyethylene glycol or polypropylene glycol. These dinitrates are chemically somewhat similar to trinitrates, but are less temperamental in their behavior.

Magnesium Working

➤ TWO METHODS for cold-working the light metal magnesium, without materially reducing its strength. One, on which patent 2,378,679 was granted to Gerhard Ansel, has to do with the production of flat sheets; slightly roughening the surfaces of the reducing rolls turns the trick. The other, covered by patent 2,378,729, issued to

Herbert W. Schmidt, is a method for cold-drawing tubes without the use of an internal mandrel; increase in internal compressive strength is claimed. Both these metallurgists are employed by the Dow Chemical Company of Midland, Mich., to which firm they have assigned their rights.

Smooth as Silk

➤ A DEVICE that shows just how smooth is "smooth as silk," on which patent 2,378,614 was obtained by Dr. Charles T. Zahn, of Wilmington, Del., assignor to the American Viscose Corporation. The gadget is very simple. A continuous loop of the thread or yarn whose smoothness or roughness is to be measured is hung on a grooved wheel. A second grooved wheel is hung on the bottom of the loop. Attached to the lower wheel is an arm bearing a graduated scale, which moves past a fixed pointer. When the upper wheel is rotated, moving the loop like a belt, it slips little if the yarn is rough like tweed, and the scale climbs up against the pointer. If the yarn is smooth like nylon, it slips much, and the scale reading is correspondingly low.

Three Years from Idea to Combat

➤ THREE YEARS are often required before new weapons and equipment reach combat areas in sufficient quantity to make them effective, reports Brig. Gen. Franklin O. Carroll, Chief of the Engineering Division of the Air Technical Service Command. There have been many new devices and weapons developed since Pearl Harbor, but some of these have yet to receive their baptism of fire.

"The intervening time is spent in testing, perfecting, and preparing production lines of industry to turn out the new weapons in volume," General Carroll explained, speaking as the guest of Watson Davis, director of Science Service, on the CBS radio feature, "Adventures in Science."

Many of the devices now used by the Army Air Forces will probably find wider use in civilian applications after the war, he predicted. As illustrations, General Carroll pointed to the inexpensive planetarium, now used in the study of navigation, which can easily be set up in a school room for use in the study of astronomy, navigation and allied subjects.

Ways of protecting metal, wood and other materials from the ravages of moisture, fungus and other things that cause metal to rust and other materials to deteriorate, have been worked out in the laboratories of the Air Technical Service Command.

Your postwar home may be better insulated as the result of tests being made on homes for our men who fight in the Arctic, he reported. If you live in an isolated region, you may be able to receive your postwar home completely prefabricated flown in by air. The Air Technical Service Command has already developed a hospital building which can be flown anywhere in the world in knock-down form and erected ready for the care of our wounded in a few hours, he stated.

As Tool or Raw Material
Yellow Element is Essential

Sulfur in the Metabolism of Industry

Fourth of a Series on Basic and War Chemicals

by Dr. C. M. A. Stine

Vice-President Advisory on Research and Development, E. I. du Pont de Nemours & Co.

➤ Peculiarly appropriate in the war production picture is a heavy schedule at the brimstone mines.

For brimstone—literally "burn stone"—has been associated with wars since the days of the ancient "Greek fire." Brimstone is sulfur, and the Greeks' crude incendiary bombs were concocted of sulfur, pitch and other inflammable substances, molded into lumps or poured into buckets and then ignited and hurled upon enemy ships or towns.

Sulfur also went to war in combination with saltpeter and charcoal, the three forming gunpowder, an invention hundreds of years old.

And today this ancient chemical, chiefly as sulfuric acid, is helping arm the United States, not with chunks of flaming brimstone, but with high-powered shot and shell, ships and tanks and planes. In war as well as in peace sulfuric acid is a skillful jack-of-all-trades, employed directly or indirectly in the creation of countless thousands of articles, from rayon and movie film and fertilizer to gasoline and guns and smokeless powder and TNT.

Both a tool and a raw material, it is, to change the figure, as indispensable in the "metabolism" of industry as water is in the metabolism of living. Disraeli, England's great prime minister of the last century, once remarked that there was "no better barometer to show the state of an industrial nation than the consumption of sulfuric acid."

As is the case with many other materials, the demand for sulfuric acid is intensified when a nation goes to war. In World War I submarine activity cut off much of our sulfur supply from Italy, where the molten material had been spewed out of volcanoes to solidify on the slopes, and from Spain, where it occurs in the form of iron pyrites (fool's gold).

This situation gave new impetus to the American brimstone mining industry, which had started early in this century along the Gulf Coast. Here, in the cap rock overlying salt domes 500 to 1500 feet beneath the surface, are tremendous stores of almost chemically pure sulfur. An ingenious technique, known as the Frasch process (after its inventor, the American chemist, Dr. Herman Frasch), is employed to bring up the sulfur without sending men down after it. A well, similar to an oil well, is drilled, and down this hole goes a set of pipes, one inside another in a concentric arrangement. Superheated water, above the 240-degree melting point of sulfur, is forced down the outermost pipe and escapes from holes near the bottom to

penetrate and melt the surrounding sulfur. The molten sulfur is now forced up through the second pipe by compressed air sent down through still a third pipe. The underground cavity created is later filled in with mud. The brimstone miners all work above the ground, and in fact must wear dark glasses to protect their eyes from the glare of the bright yellow sulfur.

The molten sulfur is piped into a nearby sump or pool, lined with cast iron and heated with steam, and from here it flows to gigantic wood or sheet-metal vats where it spreads out evenly and cools. After a vat is filled the sides are removed, to leave standing a huge "iceberg" of gleaming yellow sulfur, perhaps a third of a mile long, 200 feet wide and fifty feet high. This solid block must now be "quarried" with explosives to break it up into chunks for shipment in freight cars.

When the World War I demand for sulfur increased, prospecting along the Gulf Coast uncovered more deposits and there are now a number of large brimstone mines in this area. With a production of more than two million tons yearly, operators of these mines have met the increased demands of World War II. America also has large pyrites deposits in Virginia and Tennessee, providing us with additional security in the home supply of this indispensable material.

While sulfur is used as such in the processing of many things — rubber goods, for example—its greatest outlet is in sulfuric acid, about 10,000,000 tons of which were produced in this country last year. Additional plant capacity is now being installed. The acid is made by burning sulfur in air —it burns with a pinkish blue flame. During this process the sulfur unites with oxygen to form sulfur dioxide, a stifling gas familiar to those who have fumigated rooms with sulfur candles. When "urged" by a catalyst —usually a metal such as platinum— sulfur takes on another atom of oxygen, forming sulfur trioxide—SO_3. This readily combines with water, H_2O, to form H_2SO_4, sulfuric acid.

The entire process takes place in closed vessels and pipes, so that the workers are protected from the gases. In this connection it is of interest that in certain industries, such as smelting, sulfur-containing waste gases are captured and made into sulfuric acid as a protective measure in itself. This prevents the gases from escaping and injuring surrounding vegetation. Originally undertaken as a waste-disposal procedure it is now a profitable sideline of these industries.

Usefulness of sulfuric acid in a great many manufacturing processes is dependent upon the fact that it is a very "thirsty" chemical. In the numerous chemical reactions where water is an unwanted by-product, sulfuric acid quickly gets the water out of the way by combining with it to form hydrates. The acid can afterward be reconcentrated by heating and driving off the water, when it is again ready for use. This water-removing job is its major role today in the making of explosives. (Black powder, which contains sulfur as an actual ingredient, is little used in military explosives.) Sulfuric acid is also a vital component of storage batteries, which are used in thousands of military machines.

Largest single consumer of sulfuric acid is the fertilizer industry, which

employs it chiefly to treat phosphate rock in making phosphate food for the soil. Second most important user of the acid is the petroleum industry, where it is almost indispensable in the refining of oil, kerosene and gasoline. But it is only a tool here and no trace of sulfuric acid appears in the finished product. If it did it would ruin most of our machinery.

Tremendous quantities of sulfuric acid are used to "pickle," that is, to remove the scale and rust, from metals before their fabrication into guns, ship plates, tanks, airplanes and the now jealously guarded family car. It is widely used in the textile and paper industries. It even serves, in the form of alum, to remove impurities from drinking water. Here again, as in the case of gasoline, rayon, steel and many other articles, the acid makes a quiet exit before the article reaches you.

Like the milkman, sulfuric acid is seldom seen, but it would be badly missed if it failed to do its job.

Gasoline and Diesel Oil from Natural Gas

➤ GASOLINE and other liquid hydrocarbons may be made from natural gas at a manufacturing cost, for the gasoline, of approximately five cents a gallon, by the so-called Synthol process. Paul Ryan of the M. W. Kellogg Company has described the various technical steps of the process. The natural gas costs about five cents a thousand cubic feet. Diesel fuel and various chemical compounds are obtained at the same time.

Seven major steps are involved in the process. They are purification, synthesis gas preparation, synthesis reaction, condensation, gas separation, stabilization and fractionation of the liquid hydrocarbon products into gasoline and diesel oil, and the separation and recovery of the liquid chemical compounds.

Sulfur and other deleterious compounds are removed in the purification, the natural gas is converted to carbon monoxide and hydrogen in the synthesis gas preparation step, and in the next step these are converted, in the presence of a selected catalyst under controlled conditions, into the desired hydrocarbons and chemcial compounds.

These must be condensed into liquid form in condensers, and in the gas separator the oil layer containing the liquid hydrocarbons is removed from the water layer containing the chemical compounds. The various liquid hydrocarbons are stabilized and fractionated into gasoline and diesel oil in the last step in the process.

The plant to make the liquid hydrocarbons from natural gas should be located near large gas reserves because approximately 11,000 cubic feet of gas are required to produce one barrel of liquid hydrocarbons. The Synthol process of the Kellogg Company presents for some oil companies "interesting postwar possibilities for the economic and profitable development of new uses for an old natural resource."

Eucalyptus trees in Australia are important sources of essential oils.

Horses, Rabbits, Pills and Capsules Keep Medicine Manufacturers Alert

And Now—Oral Penicillin!

Reprinted from FOR INSTANCE *of American Cyanamid Co.*

➤ THE BUSINESS of manufacturing medicines involves the great task of making extensive plants keep step with the swift advances of science; witness the ten-year saga of the series of products for combating infections!

First there were the biologicals derived from the blood of immunized horses. The anti-pneumococcic sera, for example, reduced mortality of pneumonia cases from 40% to approximately 10%. So over the years from 1930 to 1935, sera that required ten months to bring up to the desired titer in hundreds of horses were developed for a growing list of types of the disease.

Whereupon science found that rabbit sera had certain advantages which made them superior to horse sera; an alert medical profession promptly switched and it became necessary to cover our hillsides with hutches for 22,000 rabbits to meet the new demand while the accumulation of perishable horse sera inventory went 'outdated' on the shelves.

As soon as the business in rabbit sera was well established, sulfapyridine was invented and new plants had to be rushed to completion to supply it. It did not have to be provided in 32 variants for the 32 types of pneumonia, as sera did, and it came as a pill instead of an injection, so it displaced sera in a big way. But sulfathiazole was presently found to be better—less toxic—and the plants to make that were hardly going before the scientists showed the world that sulfadiazine was still less toxic and the drug of choice! The war demand came along and complex equipment was developed, built, doubled and redoubled, to turn out sulfadiazine in terms of tens of thousands of pounds a month for the armed forces and then, in 1943, in supplies adequate for impatient civilians.

But amid the brow-mopping of 1943, when the demands were caught up with, came the disturbing scientific news of the new laboratory wonder, penicillin. To this the business answer was—"Yes, but nobody knows yet how to make penicillin in commercial quantities." That, however, was not enough to deter the Surgeon General, and presently the W.P.B. was at the doors of twenty manufacturers saying, "Even if you must make it all by thimblefuls, the soldiers must have it! Get going!" And they got going—racing, in fact—and by 1945 the Army had enough and could let penicillin go on commercial civilian sale.

But penicillin was administered only by injection and had to be given often, which had the effect of limiting its use to administration by doctors and nurses, mainly in hospitals. If given by mouth, it seemed to be mostly destroyed in the stomach. There are familiar ways of getting capsules

past the stomach by protecting them with so-called enteric coatings but those devices did not work well with penicillin.

So, of course, just as the penicillin-by-injection business is settling to its gait, the laboratory reports a way of putting a stable salt of penicillin into a capsule with an oil which aids the penicillin in passing safely through the stomach but emulsifies promptly in the intestines and releases the penicillin into the blood stream. So the physician can instruct the patient to take a prescribed series of doses "and call me up tomorrow if you don't feel better." Penicillin that is to be given by mouth does not have to be treated to eliminate certain fever-producing substances called pyrogens which cause trouble in intravenous solutions, and professional attendance—with a needle—is not required every time it is administered. Moreover a more constant effective concentration of the drug in the blood is attainable. A single oral dose (90,000 units) will maintain a fairly uniform "therapeutic blood level" for at least four hours whereas comparative tests show that two or three, or possibly more, smaller injections would be required to maintain a similar concentration of penicillin in the blood over the same period.

Thereby the battle with bacteria swings to a new front and manufacture swings heavily with it, ever alert for the next discovery that may alter the art again! Perhaps the next will be "Penicillin X," a fraction which has been recently separated from penicillin and which may be even more powerful!

Simple Chemical Test Determines Butter Quality

➤ A SIMPLE chemical test has been developed to determine the quality of butter, to supplement the ordinarily used method that depends on the human senses of taste and smell. A chemically pure fat solvent, saturated with a neutral red color, is used. Melted butter put in it brings out the red; the more rancid the butter, the stronger the color. The development is the result of work at the Cornell University Agricultural Experiment Station.

The chemical used is pure xylol. In the test, one cubic centimeter of milkfat is melted in the xylol, which has been saturated with the neutral red color, and the resulting product compared with the different shades of red in a standards series. These standards contain known quantities of oleic acid, one of the acids commonly measured in butter. A strong red color after the processing indicates a strong rancid butter. The lighter the shade of red, the less the rancidity.

The new method may be used by creameries and butter dealers with only the simplest training. It may possibly be usable also in grading cream. It was discovered in 1942 by Professor George Knaysi, bacteriologist, while working on types of fats in the cells of bacteria, and later applied successfully to butter by him and Professor E. S. Guthrie of the dairy department.

New Mechanical Devices Of Interest to Technicians

Gadgets Chemists Can Use

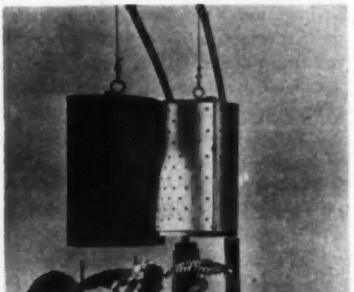
➤ From cooling drinks to baking varnishes run the accomplishments of these recent inventions, which utilize radiant energy in clever ways.

Drink cooler and sipper is a combination glass device with an elongated container to hold a refrigerant material and a tube constructed in one side for sipping the liquid. When placed in a filled drinking glass it cools the liquid, particularly as it is sipped.

Sorting tiles by color, electronically and automatically as they emerge from kilns on conveyor belts, is successfully performed experimentally. Cathode-ray oscilloscope and phototube convert a ray of light reflected from each passing tile into an electric impulse that shuttles it to the proper bin.

Ultraviolet radiations are prevented from passing through transparent plastics, especially those of organic esters of cellulose, by a newly patented process. Certain cinchona or cinchona-like compounds such as the acid salts of quinine, quinidine, cinchonine or chinchonidine are added to the plastic.

Light pencil, used to mark sensitized photographic surfaces, has within its opaque barrel a small dry battery, a light bulb separated from the battery with a spring, and a projecting point of lucite or glass through which a narrow light beam may escape. Pressure on the point forces the bulb against the battery.



Evaporator, to produce films on all types of surfaces, is used in making mirrors by evaporating metals, such as aluminum, chromium, silver and gold, on the surface of glass. It is also used to apply low-reflecting surfaces to lenses in field glasses. The picture shows its hood raised for loading.

Portable infrared unit, for use in industrial plants where quick heating of small machine parts is required, is a single infrared bulb in a reflecting shield, similar to some types of reading lamps, mounted by an adjustable arm on a portable stand. One use is to bake insulation varnishes on small motors.

An Industry in Search of A New Raw Material

Rare Alcohols from Improved Cattle Diet

by Leo M. Christensen

From a chapter, Uses of Starch and Starch Products in the Fermentation Industries, from a new book, *Chemistry and Industry of Starch, Starch Sugars and Related Compounds,* edited by Ralph W. Kerr. (Academic Press, Inc., $8.50).

➤ The fermentation industries constitute a branch of chemical manufacture in which starches and sugars are the principal raw materials. These are converted by the use of the enzymes in yeasts, molds, and bacteria into a number of useful chemicals. The best known and the one of greatest commercial interest is ethyl alcohol, but other fermentation chemicals, such as *n*-butanol, acetone, lactic acid, citric acid, gluconic acid, glycerol, and 2,3-butylene glycol, are also of large present or potential commercial importance. Many other chemicals of commercial interest can be made by the action of microorganisms upon carbohydrates, and there is a growing industrial interest in such processes. E. I. Fulmer and C. H. Werkman (The Chemical Action of Microorganisms, Charles C. Thomas, Baltimore 1930) have presented an excellent index to these fermentative reactions.

As in other branches of chemical manufacture, the fermentation industries have used the raw material at hand that costs least. During the past 25 years, the carbohydrate of lowest cost suited for use in fermentation processes has been blackstrap molasses, a by-product from the manufacture of cane sugar, for which there has been no other large market. Because it is a by-product, it has been sold at a price it brings in the competitive market, and it has been available at a level just below the average price of corn and other competitive raw materials. The fermentation industries have been using about 2 million tons of blackstrap molasses each year, which amount is nearly all of the total world production.

Recently (1942), the raw material situation changed considerably. First, it has been found difficult to transport supplies of foreign raw materials during periods of a disruption in world trade. Second, the demand for the fermentation chemicals has expanded to the extent that there is not enough blackstrap molasses produced to supply the needs. During 1942, the use of grains in the fermentation industries expanded materially and a continued expansion seems assured for the near future. It is anticipated that in 1944 the fermentation industries will be using grains at the rate of 6 million tons or more per year, but current developments now in the laboratory stage might conceivably increase this consumption by 50 per cent. Thus, starch has become the principal raw material for fermentative processes, and black-

strap molasses has accordingly become relatively less important.

In order to understand the significance of the development mentioned above, and before a conclusion as to the permanence of this change can be reached, it is necessary to examine the interrelationship of several agricultural activities. This examination will not present all of the information necessary to form this conclusion, but it is the first and most important step in the evaluation of the basis on which this new chemical program rests.

Throughout the scientific and other literature there are found many excellent analyses of the agricultural situation which have a bearing upon this subject. The studies by Hale; Christensen, Hixon, and Fulmer; Shepherd, McPherson, Brown, and Hixon; Willkie and Kolachov; and Filley, Loeffel, and Christensen have sketched the broad outlines of agriculture and animal husbandry upon which the recent developments in the fermentation industries must stand if they are to become a permanent part of American economy. Essentially, the situation is that, in order to produce meat, dairy products, and poultry products in an efficient manner, it is necessary to feed rations containing, on the average, about 1 part of protein for 6 parts of carbohydrate. However, feed grains, such as corn, barley, rye, sorghums and oats, contain 1 part of protein to 10 parts of carbohydrate; that is, they contain either too little protein or too much carbohydrate. To correct this unfavorable ratio protein may be added or starch may be removed. In the past, in addition to domestic supplies, about a million tons of protein concentrates have been imported each year in an effort to correct this protein deficiency, and animal husbandrymen report that this amount has not been sufficient. Since such feedstuffs cannot be imported uninterruptedly, an alternative procedure, the removal of some of the excess starches, has recently been used to a larger extent than formerly.

It is interesting to attempt to compute the magnitude of this indicated starch surplus. To produce a proper balance of protein and carbohydrate in the animal feeding ration at least 10 pounds of a 30 per cent, or higher, protein concentrate should be fed with 90 pounds of feed grains. Each year nearly 100 million tons of feed grains are consumed in the United States. Thus, to obtain the desired balance 11 million tons of protein concentrates should be added. It is estimated that about 6 million tons can be supplied by alfalfa, oil cake meal, packing house wastes, and other present sources, which would leave 5 million tons to come from new sources. If we assume that this protein concentrate (30% protein) is derived from grains which contain 10 per cent protein and 60 per cent starch, it is evident that a quantity of 10 million tons is the amount of the indicated normal starch surplus at present.

This surplus has been used in the past to some extent by the corn-milling and fermentation industries. However, by far the greater proportion of the estimated surplus has been wastefully consumed in improper feeding, the starch being converted into an excessive amount of fats or eliminated in the excreta. Therefore not all of this starch can now be said to be available, but it is to be noted that farmers are

rapidly adopting better feeding practices for their livestock and that the starch surplus is steadily becoming more evident. The assumption is made that education in respect to animal feeding will continue and that the indicated starch surplus will continue to materialize and supply the technical and economical basis for the development of fermentation and other industries that use starch. It is essential, however, that these industries be carefully coördinated with the agriculture which supplies the starch and uses the residual proteins. Among obvious reasons why this coördination is essential is that it may provide for the maintenance of soil fertility and of sound land use practices.

New Process for Making Ethyl Chloride

➤ ETHYL CHLORIDE, the chemical used to make tetra-ethyl lead that takes the knock out of gasoline, will soon be in production by a new process in a plant under construction in Baton Rouge, La. The process, developed by the Ethyl Corporation, yields ethyl chloride by reacting chlorine with waste products from one of the corporation's other ethyl chloride plants, also located here. The chemical has many uses in addition to its service in gasoline and in high-octane aviation fuel, several of which are connected with the war effort.

The chlorine for the new process is produced by breaking common salt electrically into its two parts, sodium and chlorine. The sodium produced is used in the manufacture of tetraethyl lead after it is combined with metallic lead to form a lead-sodium alloy.

The two previous processes for producing ethyl chloride are based on the hydrochlorination of alcohol, and on the hydrochlorination of ethylene. These materials are both in the shortage category because of the tremendous demand for them in making detonating powders, butadiene for synthetic rubber, and other war essentials.

Ethyl chloride is used in dentistry as an anesthetic on abscessed gums, and for general anesthesia in short operations, with the advantage of no after-effects. Chemical applications include production of ethyl cellulose, which is the basis for certain plastics, and catalyzing synthetic rubber. It is also used as a constituent of cognac essence, and sometimes in mechanical refrigerators as a refrigerant.

Answers to Chem Quiz on Page 19

1. *t.* LEO HENDRIK BAEKELAND (1863-1944), Belgian-American, invented photographic printing paper sensitive to artificial light, and bakelite, one of the earliest synthetic plastics.

2. *m.* MARCELLIN PIERRE EUGENE BERTHELOT (1827-1907), French, studied the theory of organic compounds and of explosives, and the literature of the alchemists.

3. *i.* CLAUDE LOUIS BERTHOLLET (1748-1822), French, worked with Lavoisier on chemical nomenclature and structure of compounds and studied gunpowder and dyes.

4. *l.* JÖNS JAKOB BERZELIUS (1779-

1848), Swedish, determined atomic weights and combining weights and was a pioneer in applying electricity to chemistry.

5. *g*. Robert Boyle (1627-1691), English, was the author of the "Sceptical Chymist" and of Boyle's Law, and was one of the founders of the Royal Society.

6. *u*. Wallace Hume Carothers (1896-1937), American, played a leading part in the development of Neoprene and invented Nylon.

7. *k*. Humphry Davy (1778-1829), English, discovered "laughing gas," invented the miner's safety lamp and isolated a number of metals electrolytically.

8. *o*. Josiah Willard Gibbs (1839-1903), American, formulated the Phase Rule which reduces to calculation the conditions under which compounds form.

9. *f*. Johann Rudolf Glauber, (1604-1668), German, prepared a large number of acids, salts and other inorganic compounds new in his time.

10. *n*. Friedrich August Kekulé (1829-1896), German, introduced the theory of the ring formation in the structure of benzene, foundation of the aromatic series of compounds.

11. *q*. Henri Moissan (1852-1907), French, isolated fluorine, studied high-temperature reactions and believed he had made diamonds artificially.

12. *d*. Theophrastus Bombastus von Hohenheim, *alias* Paracelsus, (1490-1541), German, introduced chemical remedies and experimental techniques into medicine at an early date.

13. *h*. Joseph Priestley (1733-1804), English-American, prepared oxygen from mercuric oxide, naming it "dephlogisticated air," studied a variety of other gases, and emigrated to America because of religious and political difficulties at home.

14. *p*. Ira Remsen (1846-1927), American, taught, founded the American Chemical Journal, synthesized saccharin.

15. *c*. Abu Bakr Muhammad ibn Zakariya al-Razi, known as Rhazes in literature (9th c. A.D.), Persian, applied chemical knowledge to medicine and wrote in Arabic.

16. *s*. Edgar Fahs Smith (1856-1928), American, worked on atomic weight determinations but was especially interested in the history of chemistry in America.

17. *j*. Louis Jacques Thénard (1777-1857), French, advanced knowledge of the structure of many chemicals, in association with Gay-Lussac, and promoted the teaching of chemistry.

18. *a*. Theophrastus (372-287 B.C.), Greek, succeeded Aristotle as head of the Peripatetic School and wrote on plants, stones, physics, sensations and "ethical characters."

19. *e*. Jean Baptiste van Helmont (1577-1644), Belgian, was interested in fermentation, and coined the word "gas."

20. *r*. Jacobus Hendricus van't Hoff (1852-1911), Dutch, worked out the theory of stereo-isomerism of chemical molecules and developed the idea of the asymmetric carbon atom.

21. *b*. Zosimos of Panoplis (3rd or 4th c. A.D.), Egyptian, is the earliest writer on alchemy of whom we have the genuine writings.

Reviewing Science News as Reported "by Science Service"

Twenty Years Ago This August

➤A REPORT from Germany in August 1925 foreshadowed a World War II development, as the International Research Council met at Brussels without German participation. It is interesting to read that at that meeting French, Belgian, Czecho-Slovakian and Polish delegates favored exclusion of German scientists, while delegates from the United States, Sweden, Denmark, England, Norway and Holland felt that "danger faces the present international organizations if the situation is not relieved in the near future."

The question, however, was settled for the time being by the legalistic rule of two-thirds majority, which meant 53 votes necessary for admission of the Germans. Delegates attending the meeting controlled only 52 votes. "Thus even if the delegates had been unanimous in their desire to admit the Central Powers, which was 16 votes from the truth, no changes could have been made."

From Berlin, Dr. Kurt Stille announced his development of an invention by the Dane, Waldemar Poulsen, which would permit recording on a wire of electro-magnetic impulses, so that they could be preserved and repeated indefinitely. Dr. Stille hopefully announced that his device would make the phonograph obsolete.

In America, farmers in Nebraska were preparing a test case to decide whether a farmer could refuse to have his cattle tuberculin-tested, according to state law; and psychiatrists were hoping to set up an international foundation headed by Prof. Sigmund Freud.

The invention looking toward new war was reported by Science Service:

Fireproof Gas Tanks Like Puncture-Proof Tires

➤"AN AEROPLANE gasoline tank which may be repeatedly perforated by incendiary or explosive bullets without bursting into flames, or even leaking, is the latest development in aviation reported from Vienna. The tank is the usual metal type, but with a peculiar interior coating, the composition of which is a carefully guarded secret with the inventor, probably on the order of the liquid gums placed in automobile tires to make them puncture proof. There is also, according to the claims of the patentee, a special mechanism inside the tank which eliminates all the effects of explosion, either of bullets or of gas fumes.

"The inflammatory bullet, upon entering the tank, is immediately enveloped with a coating of some sort of material that extinguishes the flame, and at the same time prevents a phosphorus-coated bullet from leaving a deposit.

"In a test made by expert army witnesses, a series of twenty bullets were fired through the experimental tank, which was filled half with gasoline and half with inflammable gas. The bullets were fired in a series of one explosive, one phosphorus and one

solid, in rotation. After the twenty rounds had been fired with no bad results, the tank was set in an aeroplane, which then made an hour's flight using only the gasoline from the apparently perforated tank. No leak or fire occurred, and no other trouble of any kind.

"The invention is arousing great interest in the war department, as the figures of the past Great War taken from the German war office show that 80 per cent of the planes brought down in flames were fired from phosphorus bullets, or caught fire from tank leaks."

Resources World Peace Problem Leading Geologist Declares

Give Peaceful Nations Minerals

➤ EQUAL ACCESS to the world's minerals for all peaceful nations lies at the very heart of the problem of world peace, Dr. Charles K. Leith, University of Wisconsin geologist and leading government consultant, believes.

Some wise administration must be devised, Dr. Leith said, to withhold the minerals so necessary to war-making from nations that threaten the peace of the world.

"Minerals are irreplaceable assets which are being depleted at an alarming rate," Dr. Leith declared. "No nation has enough of all commercial minerals. The United States is better supplied than any other nation, but during the war it has had to import about 70 varieties of minerals. Interdependence of nations as to minerals is a physical fact, not theory.

"Since the first World War, as nations have waked up to the overwhelming importance of mineral supplies both for their future industry and for their security, there has been a world-wide scramble to control them, resulting in growing international friction. The degree of success in acquiring mineral supplies measures war-making power in these days of mechanized war. There now looms before us the problem of equal access to the world's minerals."

An adequate answer to world mineral control will require not only international co-operation based on good will and pious hopes, but a very high order of scientific fact-finding and analysis, Dr. Leith said.

"The United States and the British Empire have been leaders in the development of the world's minerals," he explained. "Between them they control politically and commercially nearly three-fourths of the world's known mineral reserves. Whatever their attitude may be it is obviously a critical factor in finding an answer."

Dr. Leith spoke during the intermission of the New York Philharmonic Symphony broadcast over CBS sponsored by the U. S. Rubber Company.

Buffalo-grass seed, harvested and stored over winter, germinates poorly unless subjected to rough treatment such as soaking in a weak solution of saltpeter for 24 hours, bagging it wet, and holding for six weeks in 40-degree cold storage.

The Activities of Science Service

are directed toward presenting science in all its aspects to the people of the world. Through newspapers, radio, magazines, experimental kits and other media, science is interpreted and diffused.

For Individuals:

SCIENCE NEWS LETTER (weekly) summarizes the march of science for scientists and non-scientists alike. This unusual magazine-style *report* brings you the newest information on changes and progress in all fields of science and invention, reporting meetings, summarizing journal articles and reviewing books. $5 a year.

OVERSEAS SCIENCE NEWS LETTER (monthly) takes the latest in science to our fighting men overseas and to scientific good neighbors in foreign lands. Offset printed on thin paper in reduced size, it is sent to U. S. fighters by first class mail for $1.25 per year.

THINGS *of science* (monthly) consists of a box or bulky envelope of science exhibits and experimental materials. These new or unusual, natural or fabricated products are accompanied by complete explanations, suggested experiments and museum-style legend cards for each specimen included in the unit. $4 per year, 50 cents a unit.

CHEMISTRY (monthly) presents the background and current progress of a great and important field of science, in attractive pocket-sized format. Illustrated, with entertaining features that aid the student. The latest of Science Service publications. $2.50 per year.

For Newspapers:

NEWS AND FEATURE SERVICES that provide daily newspapers and other publications with complete, authoritative and interesting coverage of all advances of science. Daily mailings, weekly science page, health column, star maps, etc., are serviced.

For Groups:

SCIENCE CLUBS OF AMERICA, administered by Science Service, brings together and provides material for over 7500 clubs in secondary schools and elsewhere, conducts the annual Science Talent Search, and stimulates study and research by boys and girls as a hobby activity. Affiliation is free.

SCIENCE SERVICE is the endowed, non-profit institution for the popularization of science, incorporated and established in 1921.

Board of Trustees—*Nominated by the American Association for the Advancement of Science:* Edwin G. Conklin, American Philosophical Society; Otis W. Caldwell, Boyce Thompson Institute for Plant Research; Henry B. Ward, University of Illinois. *Nominated by the National Academy of Sciences:* Harlow Shapley, Harvard College Observatory; Warren H. Lewis, Wistar Institute; R. A. Millikan, California Institute of Technology. *Nominated by the National Research Council:* C. G. Abbot, Smithsonian Institution; Hugh S. Taylor, Princeton University; Ross G. Harrison, Yale University. *Nominated by the Journalistic Profession:* A. H. Kirchhofer, Buffalo Evening News; Neil H. Swanson, Executive Editor, Sun Papers; O. W. Riegel, Washington & Lee School of Journalism. *Nominated by the E. W. Scripps Estate:* Max B. Cook, Scripps Howard Newspapers; H. L. Smithton, Executive Agent of E. W. Scripps Trust; Frank R. Ford, Evansville Press.

National Headquarters:
1719 N Street, N.W.
Washington 6, D. C.

Every month our members get an unusual box or bulky envelope containing scientific material — novel, intriguing, surprising.

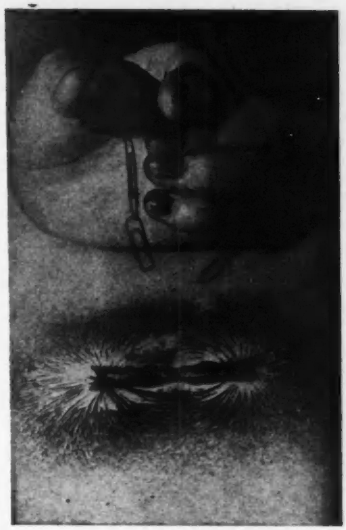
Month after month . . . THINGS of science have come to members. For example:

Optics	Bi-Metallic	Indicators	Salt	Insects	War Rubber
Synthetic Rubber	New Fabrics	Fern Fossils	Transparent Packaging	Cork	Glass Fiber
Plastics	Whey Candy	Seeds	Casein	Rayon	Dehydrated Food
Strategic Minerals	Meteorite	Sulfur	Plywood	Prince Rupert's Drops	Spice
Bread Vitamins	Plant Hormones	Treated Wood and Cloth	Oil Seeds	Felt	Rubber Plants
Finger-printing	Fire Psychology	Buoyant	Unusual Paper	Material Detecting	Plastic Pilot Aids
	Mineral Optics	Fiberglas	Coins		

You are invited to join our group for a trial membership of six months. To you we shall each month dispatch a unit of scientific material, unusual, intriguing, surprising. With each unit will come a brief, clear, Members' Bulletin explaining the contents. For each separate exhibit in each unit there will be a museum-style legend card.

Since this is a non-profit organization, operated as a public service by SCIENCE SERVICE, the membership charge has been set at $2 for the six months' trial. To those who send us the Application Form immediately we shall send a GIFT UNIT in appreciation for their prompt acceptance of this invitation.

We recommend that you send us your Application for trial membership now because members are added only when there are vacancies in the 5,000 membership. Please send your Application with remittance of $2 to THINGS of science, Science Service Building, 1719 N Street, N.W., Washington 6, D. C.



● *Experiment on magnetism performed with Things lodestone.*

To *Things* of science, 1719 N St., N. W., Washington 6, D. C.

Please enroll me for Membership, sending me the first available unit right away, the other units to come each month—a total of six monthly units of THINGS of science, all sent postpaid, for which I enclose $2. And send me, free, the Gift Unit offered in appreciation for my prompt acceptance of your invitation.

*Name*_____

*Street Address*_____

*City and State*_____

➤ **AMERICAN newspapers have played a leading role during the past two decades in informing the world about the progress of science in all fields. SCIENCE SERVICE, the institution for the popularization of science and the world's only science syndicate, has provided the day-by-day reporting and background of scientific advances that have made this possible. Among the newspapers that have joined with Science Service in this important public service are:**

Birmingham (Ala.) *Post*
Phoenix (Ariz.) *Arizona Republic*
Alhambra (Calif.) *Post-Advocate*
Berkeley (Calif.) *Gazette*
Culver City (Calif.) *Star-News*
Pasadena (Calif.) *Post*
Redondo (Calif.) *Breeze*
Riverside (Calif.) *Daily Press*
San Francisco (Calif.) *News*
San Pedro (Calif.) *News-Pilot*
Denver (Colo.) *Rocky Mountain News*
Bridgeport (Conn.) *Post*
Hartford (Conn.) *Times*
New Haven (Conn.) *Register*
Waterbury (Conn.) *Sunday Republican*
Washington (D. C.) *Daily News*
Miami (Fla.) *Herald*
Evansville (Ind.) *Press*
Indianapolis (Ind.) *Times*
Council Bluffs (Iowa) *Nonpareil*
Wichita (Kans.) *Eagle*
Covington (Ky.) *Post*
Baltimore (Md.) *Evening Sun*
Boston (Mass.) *Globe*
New Bedford (Mass.) *Standard-Times*
Springfield (Mass.) *Republican*
Ann Arbor (Mich.) *News*
Bay City (Mich.) *Times*
Detroit (Mich.) *Free-Press*
Flint (Mich.) *Journal*
Grand Rapids (Mich.) *Press*
Jackson (Mich.) *Citizen-Patriot*
Kalamazoo (Mich.) *Gazette*
Lansing (Mich.) *State-Journal*
Muskegon (Mich.) *Chronicle*
Saginaw (Mich.) *News*
Rochester (Minn.) *Post-Bulletin*
Kansas City (Mo.) *Star*
St. Louis (Mo.) *Globe-Democrat*
Camden (N. J.) *Courier-Post*
Hackensack (N. J.) *Bergen Evening Record*
Long Branch (N. J.) *Daily Record*
Newark (N. J.) *Star-Ledger*
Albuquerque (N. Mex.) *Tribune*
Brooklyn (N. Y.) *Eagle*
Buffalo (N. Y.) *Evening News*
Jamaica (L. I.) *Queen's Evening News*
New York (N. Y.) *Times*
New York (N. Y.) *World-Telegram*
Niagara Falls (N. Y.) *Gazette*
Rome (N. Y.) *Sentinel*
Syracuse (N. Y.) *Post-Standard*
Troy (N. Y.) *Observer Budget*
Utica (N. Y.) *Observer-Dispatch*
Charlotte (N. Car.) *News*
Akron (Ohio) *Beacon-Journal*
Cincinnati (Ohio) *Post*
Cleveland (Ohio) *Press*
Columbus (Ohio) *Citizen*
Dayton (Ohio) *News*
Toledo (Ohio) *Blade*
Oklahoma City (Okla.) *Oklahoman & Times*
Philadelphia (Pa.) *Record*
Pittsburgh (Pa.) *Press*
York (Pa.) *Gazette & Daily*
Wilkes-Barre (Pa.) *Sunday Independent*
Providence (R. I.) *Sunday Journal*
Anderson (S. C.) *Independent*
Chattanooga (Tenn.) *Times*
Knoxville (Tenn.) *News-Sentinel*
Memphis (Tenn.) *Press-Scimitar*
El Paso (Tex.) *Herald-Post*
Fort Worth (Tex.) *Press*
Houston (Tex.) *Press*
Charlottesville (Va.) *Progress*
Lynchburg (Va.) *Daily Advance*
Norfolk (Va.) *Ledger-Dispatch*
Richmond (Va.) *Times-Dispatch*
Roanoke (Va.) *World News*
Winchester (Va.) *Star*
Seattle (Wash.) *Times*
Madison (Wisc.) *Progressive*
Vancouver (B. C.) *Province*
Toronto (Ont.) *Telegram*

★ ★ ★

SCIENCE SERVICE

g the
s of
the
cate,
cien-
ews-
rtant

rus

& &

ndent

MISTRY